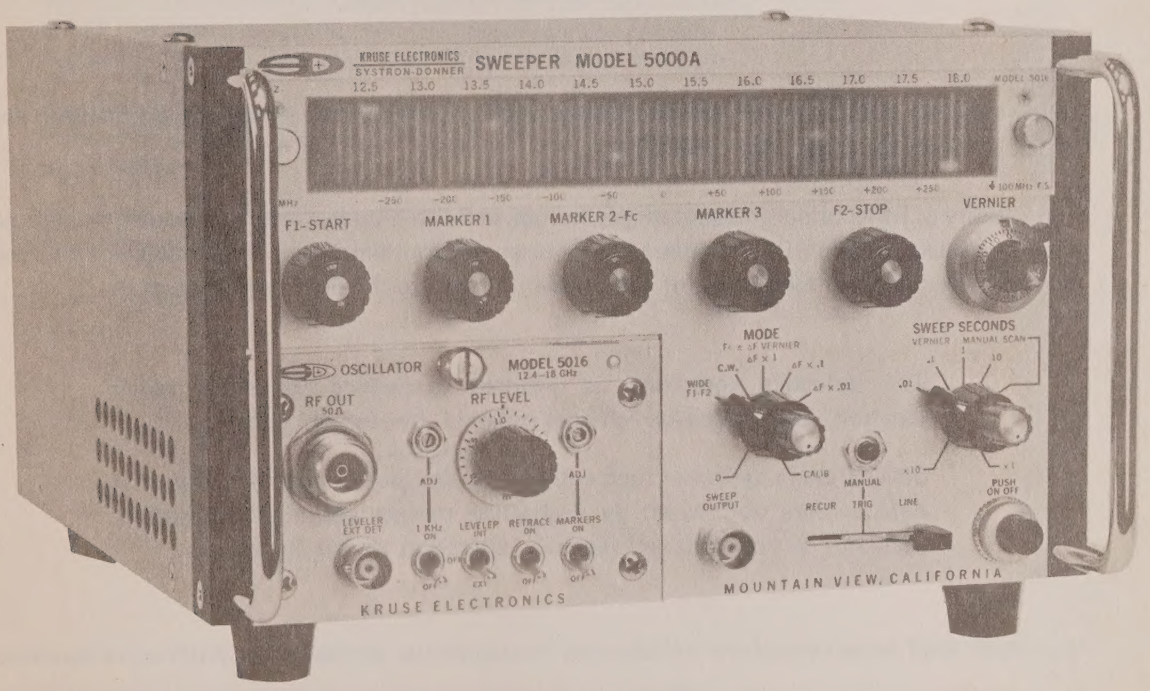
SYSTRON DONNER

OPERATION AND SERVICE MANUAL



© Copyright **1970, 1976**
SYSTRON DONNER CORPORATION
ONE SYSTRON DRIVE
CONCORD, CALIFORNIA 94518 USA

MODEL 5000A

SWEEP OSCILLATOR

MICROWAVE DIVISION
SYSTRON DONNER CORPORATION
INSTRUMENT GROUP

PRINTED **8-1-76**
MANUAL P/N **950783**

SYSTRON DONNER

EQUIPMENT WARRANTY

Seller warrants equipment of its manufacture against defective materials or workmanship for a period of one year from date of shipment.

The liability of Seller under this warranty is limited, at Seller's option, solely to repair, replacement with equivalent Systron-Donner equipment, or an appropriate credit adjustment not to exceed the original equipment sales price, of equipment returned to the Seller provided that:

The defective equipment is returned to Seller's designated repair location, transportation charges prepaid by Buyer, and,

Seller's examination of such equipment discloses to its satisfaction that defects were not caused by negligence, misuse, improper installation, accident, or unauthorized repair or alteration by the Buyer.

In no event shall Seller be liable for collateral or consequential damages due to defective equipment.

This warranty does not include mechanical parts failing from normal usage nor does it cover limited-life electrical components which deteriorate with age such as vacuum tubes, batteries, lamps, or accessories not manufactured by the Seller, but which are furnished with the Seller's equipment. Seller's liability is limited to whatever warranty is extended by the manufacturers thereof and transferable to the Buyer.

This warranty is applicable to the original Buyer only and constitutes the sole and exclusive warranty of Seller.

This warranty is in lieu of any other warranty, expressed implied or statutory and no agreement extending or modifying it will be binding upon Seller unless in writing and signed by a duly authorized officer.

SYSTRON DONNER

SERVICE DIVISION

935 Detroit Avenue • Concord, California 94518 • Phone (415) 676-5000 • TWX 910-481-9479

Thank You.

We appreciate your confidence in our products. The Service Division of Systron-Donner will ensure that this instrument is maintained at its specified performance during its warranty period. If assistance is required, please feel free to contact one of our Regional or Local Service Centers listed on the reverse side of this card.

If service, calibration or parts are required beyond the warranty period, please contact the Service Division Center nearest you. They are your representatives.

Will you take some time to help us improve our performance and insure your warranty by completing the postage-free registration card below.

Sincerely,

Richard F. Hall

Richard F. Hall
General Manager

Warranty Registration Card

MODEL NO. _____ SERIAL NO. _____ DATE RCV'D _____

Company _____ Department _____

Name _____ Title _____

Address _____ Phone (_____) _____

City _____ State _____ Zip _____

PRE-SALE ASSISTANCE
- ☐ Excellent
- ☐ Fair
- ☐ Poor

DELIVERY
- ☐ Early
- ☐ On Time
- ☐ Late

INSTRUMENT PERFORMANCE
- ☐ As Expected
- ☐ Good
- ☐ Defective

SERVICE CONTRACT AFTER WARRANTY? ☐ Yes ☐ No ☐ Check Later

PROVISIONING PARTS REQUIRED? ☐ Yes ☐ No ☐ Check Later

COMMENTS: _____

S-D Service Division Centers

NATIONAL

935 Detroit Avenue
Concord, CA 94518
Phone: (415) 825-9810
TWX: 910-481-5780

REGIONAL SERVICE CENTERS

WEST

3662 Katella Ave., Suite 105
Los Alamitos, CA 90720
Phone: (213) 596-1684

NORTHERN CALIFORNIA

735 Palomar Avenue
Sunnyvale, CA 94086
Phone: (408) 733-3133

EAST

71 Grand Avenue
Palisades Park, NJ 07650
Phone: (201) 945-4500

LOCAL SERVICE CENTERS

NEW ENGLAND

29 Gordon Street
Waltham, MA 02154
Phone: (617) 894-0559

WASHINGTON, D.C.

6615 Backlick Road
Springfield, VA 22150
Phone: (703) 451-6500

MIDWEST

2720 Des Plaines Ave., Suite 16
Des Plaines, IL 60018
Phone: (312) 297-5240

SOUTHWEST

312 N. Central Expressway
Suite 212
Richardson, TX 75080
Phone: (214) 231-8106

SOUTHERN CALIFORNIA

3662 Katella Ave., Suite 209
Los Alamitos, CA 90720
Phone: (213) 598-7678

FIRST CLASS
PERMIT NO. 57
CONCORD, CA

BUSINESS REPLY MAIL

NO POSTAGE NECESSARY IF MAILED IN THE UNITED STATES

Postage will be paid by

Systron-Donner Corporation

Service Division
935 Detroit Avenue
Concord, CA 94518

LIST OF EFFECTIVE PAGES

PAGE	CHANGE	PAGE	CHANGE
i	8-1-76	4-1	8-1-76
ii	4-1-73	4-2 through 4-4	4-1-73
iii	4-1-73	4-5	1-15-74
iv	1-15-74	4-6	Blank
v	8-1-76		
vi	Blank	5-1 through 5-3	8-1-76
		5-4 through 5-6	Original
1-1	Original		
1-2 through 1-4	8-1-76	6-1 through 6-25	8-1-76
1-5	5-15-75	6-26	Blank
1-6	1-15-74	6-27	8-1-76
1-7	8-1-76	6-28	8-1-76
1-8	Blank		
2-1 through 2-4	4-1-73		
3-1 through 3-5	4-1-73		
3-6	8-1-76		
3-7 through 3-10	4-1-73		
3-11	8-1-76		
3-12	8-1-76		

NOTE 1) All Original pages are dated 10-70 (October, 1970)

NOTE 2) Please report errors and omissions in this manual to:

SYSTRON DONNER CORPORATION
Microwave Division
14844 Oxnard Street
Van Nuys, California 91411

This report should include the manual title, date of last change, and exact location (by page, paragraph, line, or figure) of the error. Also include the model number, serial number, and numbers of modifications or options (if any) pertinent to your instrument.

TABLE OF CONTENTS

SECTION/ PARAGRAPH	TITLE	PAGE
SECTION 1	INTRODUCTION AND DESCRIPTION	1-1
1.1	SCOPE OF MANUAL	1-1
1.2	DESCRIPTION	1-1
SECTION 2	INITIAL INSTRUCTIONS	2-1
2.1	UNPACKING AND INSPECTION UPON RECEIPT	2-1
2.1.2	Removing Contents	2-1
2.1.3	Inspection	2-1
2.2	PREPARATION FOR USE	2-1
2.2.2	Operation from other than 115 V Line	2-1
2.3	REMOVAL, INSTALLATION AND INTERCHANGING OF PLUG-IN UNITS	2-2
2.3.1	Removal of a Plug-in Unit	2-2
2.3.2	Installation of a Plug-in Unit	2-2
2.3.3	Interchanging Plug-in Units	2-2
2.4	POWER CABLE	2-2
2.5	MOUNTING	2-3
2.5.1	Bench Use	2-3
2.5.2	Rack Mounting	2-3
2.6	REPACKAGING FOR SHIPMENT	2-3
2.7	SHIPPING METHOD	2-3
2.8	INSURANCE	2-3
2.9	RETURNS FOR REPAIR	2-3
SECTION 3	OPERATION	3-1
3.1	INTRODUCTION	3-1
3.2	FRONT PANEL CONTROLS AND OUTPUT CONNECTORS	3-1
3.2.1	F1-START	3-1
3.2.2	MARKER 1	3-1
3.2.3	MARKER 2-F_c	3-1
3.2.4	MARKER 3	3-1
3.2.5	F2-STOP	3-1
3.2.6	Dial Graticule	3-1
3.2.7	VERNIER	3-1
3.2.8	SWEEP SECONDS	3-3
3.2.9	VERNIER-MANUAL SCAN	3-3
3.2.10	PUSH ON/OFF	3-3

TABLE OF CONTENTS (Continued)

SECTION/ PARAGRAPH	TITLE	PAGE
3.2.11	MANUAL	3-3
3.2.12	RECUR-TRIG-LINE	3-3
3.2.13	$F_c \pm \Delta F$ VERNIER	3-3
3.2.14	MODE	3-3
3.2.15	SWEEP OUTPUT	3-3
3.2.16	ADJ (MARKERS)	3-4
3.2.17	MARKERS	3-4
3.2.18	RETRACE	3-4
3.2.19	RF LEVEL	3-4
3.2.20	LEVELER	3-4
3.2.21	1 KHz	3-4
3.2.22	LEVELER EXT DET	3-4
3.2.23	ADJ (1 KHz)	3-4
3.2.24	RF OUT Connector	3-4
3.3	REAR PANEL CONTROLS AND CONNECTORS	3-4
3.3.1	EXTERNAL AM	3-4
3.3.2	1 KHz OUTPUT	3-4
3.3.3	PHASE LOCK	3-4
3.3.4	MARKER OUTPUT	3-6
3.3.5	BLANKING OUTPUT	3-6
3.3.6	EXT'L SWEEP/INT'L SWEEP	3-6
3.3.7	SWEEP OUTPUT	3-6
3.3.8	EXT'L SWEEP	3-6
3.3.9	EXTERNAL TRIG	3-6
3.3.10	FREQ VOLTS	3-6
3.3.11	LINE	3-6
3.3.12	+20 V	3-6
3.3.13	GROUND	3-6
3.3.14	FUSE 1A	3-6
3.3.15	115 V/230 V SWITCH	3-6
3.4	OPERATING PROCEDURE	3-6
3.4.2	Internal Sweep Mode of Operation	3-7
3.4.3	External Sweep Mode of Operation	3-7
3.4.4	Frequency Modulation	3-8
3.4.5	Amplitude Modulation	3-8
3.5	QUIETING CIRCUIT	3-11
SECTION 4	THEORY OF OPERATION	4-1
4.1	INTRODUCTION	4-1
4.2	STABLE POWER SUPPLIES	4-1

TABLE OF CONTENTS (Continued)

SECTION/ PARAGRAPH	TITLE	PAGE
4.3	MODULATION TECHNIQUES	4-1
4.3.2	Wide Sweep Mode (F1 to F2) - Mode Switch Position #1	4-2
4.3.3	CW Mode - Mode Switch Position #2	4-3
4.3.4	ΔF Mode - Mode Switch Positions #3, #4, and #5	4-3
4.4	MODULATION GENERATORS	4-4
SECTION 5	CALIBRATION AND MAINTENANCE	5-1
5.1	GENERAL	5-1
5.2	PREVENTATIVE MAINTENANCE	5-1
5.3	CALIBRATION	5-1
5.3.5	Preliminary Statements	5-2
5.3.6	+20 Volt Power Supply	5-2
5.3.7	Sweep Generator	5-3
5.3.8	Operational Amplifiers	5-4
5.3.9	Marker Generator and Blanking	5-5
SECTION 6	PARTS LISTS AND DRAWINGS	6-1
6.1	INTRODUCTION	6-1
6.2	REPLACEMENTS	6-1

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Packaging for Shipment	2-4
3.1	Front Panel Controls	3-2
3.2	Rear Panel Controls	3-5
3.3	Phase Lock Input Specification Chart	3-9
3.4	Typical Test Setup for Measurement of Transfer Characteristics	3-10
3.5	Typical Setup for Reflected Power and VSWR Measurements	3-10
3.6	Typical X-Y Recorder Set-up to Plot Sweep Oscillator Power Output Characteristics	3-11
4.1	Simplified Schematic	4-5
6.1	Schematic Diagram	6-15
6-2	Assembly Drawing	6-17

SECTION I

INTRODUCTION AND DESCRIPTION

1.1 SCOPE OF MANUAL

This manual provides description, operating instructions, theory of operation and maintenance instructions for the Systron-Donner Model 5000A Sweeper.

1.2 DESCRIPTION

The Model 5000A Sweeper is a new generation all-solid-state general purpose instrument for high precision swept or CW applications. Built-in, ultra stable, low noise power supplies furnish DC or swept, voltage or current for operating a variety of present and planned plug-in units. A slide rule dial provides a convenient means for setting the start and end of wide band sweeps, markers, and F_c. F_c controls either the CW frequency or the center of the calibrated ΔF sweep. The Model 5000A gives you signal generator performance with sweep generator flexibility. It is easy and convenient to operate, and plug-ins are easily changed at the front panel to provide coverage of many frequency bands. In addition, its light weight and rugged construction make it ideally suited for limited space and portable applications.

Many all-solid-state Oscillator Plug-Ins covering a wide range of RF and Microwave Frequencies are available. They all utilize PIN diode modulators and provide calibrated leveled power control. Each plug-in is a complete unit and is supplied with a linear dial calibrated for direct and rapid reading of frequency.

The solid-state oscillators are voltage-tuned fundamental frequency types.* They have unlimited life, are permanantly calibrated, extremely stable and have very low spurious signals. The power output and tuning are a smooth function of frequency, free of fine structure.

Long-term instrument reliability is assured with the all solid-state design. No vacuum tubes are used. The Model 5000A will provide years of trouble-free service without maintenance. It is a permanently calibrated unit. No calibration adjustments are required or provided. Silicon semiconductors, precision wire wound and metal film resistors, and plug-in glass epoxy circuit boards are used. In addition, the conservative design gives you an instrument which is well protected against degradation and misuse.

*Protected by Patents
U.S. Patents No. 3397365; 3377568; 3416100
British Patent 1172642
French Patent 1565268

OPTIONS MODEL 5000A SWEEPER

NEGATIVE BLANKING: Option M1
Blanking output is -20 V during flyback; -0.2 V during sweep. Output impedance is 1 KΩ.

POSITIVE TUNING REFERENCE VOLTAGE: Option M3
Positive tuning reference voltage: 0 to an adjustable maximum of +10 to +35 V. For full compatibility with HP 8410A Network Analyzer.

REMOTE CONNECTOR: Option M10
Adds a connector to the rear panel for coupling marker, blanking, and horizontal sweep inputs to a Model 7000 M1 Display Unit.

EXTENDED POWER LINE FREQUENCY RANGE, 60 TO 400 HERTZ: Option M16

OPTIONS MODEL 5000 SERIES OSCILLATOR PLUG-INS

INTERNAL POWER LEVELING: Option M2
Available on 5010 through 5013 plug-ins (500 MHz to 4 GHz). Allows the RF output of the plug-in to be leveled at the RF out connector without the use of external levelers (all plug-ins below 500 MHz include internal leveling circuitry).

CONSTANT PHASE-LOCK SENSITIVITY WITH 10 KHZ BANDWIDTH: Option M6
Normally, the sensitivity at the phase-lock input of the sweeper mainframe (which is connected directly to the plug-in) is a function of the RF output frequency. Option M6 changes this to a constant (customer-specified) factor of the plug-in bandwidth per volt (bandwidth in MHz).

POWER METER LEVELING: Option M7
Units with this option may be leveled with the "recorder" output of HP 431B/C series power meters and some other power meters. The plug-in includes a selector for normal or power meter leveling.

POWER METER LEVELING: Option M7A
This is similar to Option M7, but for HP Model 432 power meters.

RF LEVEL CONTROLS: Option M9
The RF LEVEL controls of units with this option are calibrated in dBm (0 dBm = 1 mW into 50 Ω).

RF OUT CONNECTOR: Option M16
This option substitutes a Type TNC RF OUT connector for the normally-used Type N; this option is not available for 5014, 5015, and 5016 plug-ins.

RF OUT CONNECTOR: Option M22
This option substitutes a 3 mm Type SMA RF OUT connector for the normally-used Type N connector; especially useful above 10 GHz.

RF OUT CONNECTOR: Option M24
This option substitutes a precision 7 mm Type APC-7 RF OUT connector for the normally-used Type N connector; especially useful above 10 GHz.

ACCESSORIES

DIRECTIONAL DETECTORS FOR EXTERNAL LEVELING: Models 1020 and up.
External calibrated directional power samplers are available to provide the specified leveling and power dial accuracies. Refer to the latest Systron-Donner catalogue for model numbers and Directional Detector detailed specifications.

STORAGE CABINET: Model 9001
Holds four plug-ins with slide-rule dials attached. Can be bolted to Model 5000A for rack mount. 5-1/4 x 8-5/8 x 11-3/4 inches; 3 pounds.

RACK ADAPTER: Model 9004
Adapts Model 5000A or 9001 to 19-inch rack. Bolts to side. 5-1/4 x 8-5/8 x 11-3/4 inches; 3 pounds.

STACK ADAPTER: Model 9005
Adapts Model 5000A to Model 7000 Display Unit. Bolts 5000A to bottom of Model 7000.

VIDEO SAMPLER CABLE: Model 9105
3-foot video cable. BNC male to Sealectro. Connects video output of directional detector to leveler input on oscillator plug-ins. Supplied with directional detectors.

PHASE LOCK PLUG: Model 9106
Miniature plug to insert into Fast FM/Phase Lock input on Model 5000A Sweeper. Has terminals jumpered but not soldered. Supplied with Model 5000A Sweeper.

PEN LIFT RELAY: Model 9107
SPDT contacts, 1 A, 115 V AC rating. Barrier terminals. Attaches to rear of Model 5000A. Operated by Blanking Output.

DUMMY LOAD: Model 9201
This unit plugs into the 5000A in place of an RF plug-in, and is used when testing and adjusting the 5000A power supplies or when an RF plug-in is not used. Each pin of the interface connector is brought out to an individual test point.

SPECIFICATIONS

RF OUTPUT

Leveled with internal DC amplifier and either internal or external Directional Detector (RF Sampler-Crystal Detector) or unleveled, depending on Plug-in Model. Front-panel BNC or Type N Precision Stainless Female Connector on plug-in. Details are in the Systron-Donner catalogue.

RF OUTPUT IMPEDANCE

RF Plug-ins are furnished with 50 Ω or 75 Ω output through appropriate connectors. Leveled source VSWR approaches unity.

LEVELER INPUT

Input voltage sensitivity -10 mV/mW for Model 5000 Series Plug-ins. Leveler input voltage range 200 mV (or as otherwise specified for the particular Plug-in Model number). Input impedance 5 kΩ. Panel BNC receptacle on plug-in.

RF POWER CONTROL

Panel Control varies internal PIN diode attenuator continuously over 40 dB or greater range. Calibrated in mW when leveled and using specified sampler.

FREQUENCY CONTROL

Five color coded controls, F_1, Marker 1, Marker 2-F_c, Marker 3, and F_2, operate corresponding color coded indicators on slide rule dial. Linear slide rule dial calibrated in frequency for wide and narrow (ΔF) symmetrical sweep. Calibration accuracy of instrument is indicated on Plug-In Specifications Chart. Wide (F_1, to F_2) Sweep Start set by F_1; End set by F_2. Both may be set anywhere in band. Sweep may be up or down. CW (unswept) frequency and ΔF Sweep center set by Marker 2-F_c control. Narrow (ΔF) Sweep amplitude adjustable from 0 to ± 5% of frequency range set by Δ F x 1, ΔF x . 1, ΔF x . 01 decade switch, and continuous vernier adjustable from 0 to calibrated maximum. Calibration accuracy of narrow (ΔF) sweep is ± 10% of ΔF range selected.

FREQUENCY VERNIER

10-turn control directly calibrated in MHz adds to all frequencies in wide or narrow (ΔF) sweep. Calibration accuracy is ± 10% of reading.

EXTERNAL SWEEP

0 to 10.0 V signal scans full frequency range. (0.1 to 9.9 V scans specified useable frequency range). External signal adds to F_1 in wide F_1 - F_2 mode, at any sweep speed or Manual Scan; and to Marker 2-F_c in CW or ΔF modes at any sweep or in Manual Scan. The position of the F_2 control has no effect on the upper frequency limit.

EXTERNAL FREQUENCY CONTROL

Rear terminals provide precision +20.0 V reference for external frequency control with potentiometer connected to External Sweep input.

FAST FM AND PHASE LOCK

Negative voltage increases frequency. Frequency response, sensitivity, input impedance and maximum range specifications depend on plug-in model.

M-6 Modification:

Frequency Response:	DC to 10 kHz sweep mode DC to 10 Hz CW or Manual Scan mode
Sensitivity:	Deviation from frequency setting, 1% of the frequency per volt.
Input Impedance:	Approximately 500 kΩ
Maximum Range:	Full band, 100 volts peak to peak

AMPLITUDE MODULATION

Internal Square Wave 950 to 1050 Hz. Square wave turned off by panel switch. Stability ± 1 Hz (invariant environment); ±1 Hz/°C. +2 V square wave output at rear BNC connector. Output impedance: 1 kΩ

External AM: Unleveled, control input 0 to +10 V. Leveled, control sensitivity 100 mV/mW in Model 5000 Series Plug-Ins. Positive going increases output from RF level setting. May be used as input for power meter leveling, with power meter output polarity negative going. Input impedance 25 kΩ. Rear BNC connector.

Amplitude Control Range:	40 dB unleveled, 30 dB leveled.
Rise and Fall Time:	2 μsec leveled or unleveled.

ENVIRONMENT

0 to +55°C ambient, operating; -55°C to +85°C non-operating. 0 to 10,000 feet altitude.

POWER INPUT

115 or 230 V ± 10%, 47 to 63 Hz. 90 VA. Internal jumpers are provided for 104 or 208 V operation. Option M16 units operate from 60 to 400 Hz. power supplies.

FREQUENCY MARKERS

Three markers reduce RF output. Video markers also are available at rear BNC connector, - 1 V pulse. Output impedance 3 kΩ. RF reduction adjustable 0 to at least .2 dB by panel control. RF markers turned on or off by panel switch. Frequency of each is set by Marker 1, Marker 2-F_c and Marker 3 controls. Marker width is less than .1% of sweep range on either wide or narrow (ΔF) sweep. Marker 2 is removed on narrow (ΔF) sweep since it is sweep center. Marker accuracy ± 1% of frequency on wide sweep. On narrow (ΔF) sweep markers are directly calibrated on ΔF scale, regardless of setting of $F_c \pm \Delta F$ VERNIER.

SWEEP MODES

Internal Recurrent, Manual or External Triggered, Line Triggered, Manual Scan, or External Sweep.

MANUAL TRIGGER

Operated by panel switch.

EXTERNAL TRIGGER

Direct coupled, signal +3 V minimum, 1 μsec or longer starts sweep. Input impedance 10 Rear BNC connector.

MANUAL SCAN

Sweep Seconds Vernier control varies frequency over Wide (F_1 to F_2) or ΔF sweep setting. 10 Hz bandwidth for noise reduction in tuning amplifier.

SWEEP TIME

Decade Selector from 100 to .01 seconds. Sweep Seconds Vernier continuously adjustable over 10 to 1 range in each decade. Flyback time is 10% of decade selector setting.

SWEEP OUTPUT

Positive sawtooth sweeps 0 to +10.0 V fixed amplitude on internal Wide or ΔF Sweep. Voltage varies 0 to +10.0 V proportional to frequency on Manual Scan. Frequency accuracy and linearity on wide sweep ± 1/2% of range. Output impedance less than 100 Ω. Load current 10 mA maximum. Sweep output on both front panel and rear, BNC connectors.

TUNING REFERENCE OUTPUT

Negative reference voltage proportional to frequency; 0 to - 10.0 V. Zero volts minimum usable frequency; - 10.0 V, maximum usable frequency, voltage range proportional to sweep width, accuracy and linearity 1/2% of range. Output impedance 1 kΩ.

SPECIFICATIONS - Cont'd

RF BLANKING

RF may be turned on or off during retrace with plug-in front-panel switch.

BLANKING OUTPUT

+18 V during flyback; -0.6 V during sweep. Output impedance 1 kΩ. Rear BNC connector. For negative blanking, see Sweeper Option M1.

PEN LIFT

Use Blanking Output. For SPDT contacts, use Model 9107 Pen Lift Relay Accessory.

CONSTRUCTION AND MOUNTING

Half Rack, Bench Mounting with tilt-up base bracket and carrying handle. Handled rack adapters and plates available to join two units, side by side, for standard rack mounting. Model 9001 Plug-In Storage Cabinet or Model 9004 Rack Adapter Cabinet available for rack mounting. Model 9005 Stack Adapter is available for mounting a 7000 on top of the Model 5000A Sweeper.

DIMENSIONS

Height: 5-1/4 inches. Width: 8-1/2 inches. Depth: 11-3/4 inches from panel, 13-1/4 inches overall.

WEIGHT

15 pounds, less plug-in.

SECTION 2

INITIAL INSTRUCTIONS

2.1 UNPACKING AND INSPECTION UPON RECEIPT

2.1.1 The instrument is shipped in a specially constructed container (See Fig. 2-1) to provide maximum protection to the equipment during transit. Use care when unpacking to prevent damage to the equipment, such as cabinet paint finish, controls, indicators, connectors, etc.

2.1.2 Removing Contents. To remove the instrument from the shipping container, cut and fold back outer carton top flaps, remove top protective cushion, lift instrument clear from shipping container, open dust protection bag and remove equipment.

2.1.3 Inspection. The instrument was carefully tested and inspected prior to shipment. Inspect the instrument for damage incurred during shipment. Check that the power cable is supplied with the instrument. If the instrument is damaged in any way, follow Shipment Damage Procedure on the last page of this manual.

2.2 PREPARATION FOR USE

2.2.1 The instrument is shipped ready for use. Required power source is 115 or 230 volts AC ± 10%, single phase, which can supply approximately 90 watts of power.

2.2.2 Operation from other than 115 V Line. The instrument is normally shipped with the 115/230 V switch in the 115 V position and the jumpers on A 7 set for operation from a 115 volts AC source. For operation from other sources follow the directions below:

2.2.2.1 230 Volt Operation

a. With a small screwdriver switch the 115/230 V switch to the 230 V position. (See paragraph 3.3.15 for location)

b. Remove the 1A fuse on the rear panel and replace with 3AG, 1/2A, Slo-Blo fuse.

2.2.2.2 104 Volt Operation

a. Remove left side and bottom covers and plug-in.

b. With a soldering iron, change the position of the two jumpers on A7 from the position marked 115 V to the position marked 104 V.

c. Replace covers.

2.2.2.3 208 Volt Operation

a. Perform steps a, b, and c of 2.2.2.2

b. Perform steps a and b of 2.2.2.1

2.3 REMOVAL, INSTALLATION AND INTERCHANGING OF PLUG-IN UNITS

2.3.1 Removal of a Plug-In Unit. To remove an oscillator plug-in unit from the instrument, release its panel knurled locking knob by turning CCW. Gently pull the plug-in unit out of the sweeper panel compartment by pulling on the knurled locking knob. Remove the graticule dial for that plug-in unit from the sweeper panel by turning the dial knurled mounting knobs fully CCW. Gently remove the dial from the sweeper front panel and place in storage mounting bracket on the left side of the plug-in unit. Use the knurled screws on the dial to attach it to the plug-in.

2.3.2 Installation of a Plug-In Unit. To install a plug-in unit into the sweeper, first remove the graticule dial from the storage mounting bracket on the right side of the plug-in unit. Install the dial into the dial mounting area on the sweeper front panel. Turn the two knurled knobs clockwise while gently pressing on knobs until finger tight; make sure the dial fits flush with the panel. Insert the oscillator plug-in unit through the sweeper front panel and lock it in position by turning the knurled knob clockwise until finger tight.

2.3.3 Interchanging Plug-in Units. To interchange an oscillator plug-in unit, follow the procedures of paragraph 2.3.1 and 2.3.2 above. The sweeper instrument is properly calibrated to operate with the new plug-in unit when the precise graticule dial for the new plug-in unit is installed on the sweeper. No further adjustments are required.

2.4 POWER CABLE

2.4.1 This instrument is equipped with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the instrument for safety. The center offset-pin of the rear panel three-prong LINE connector is the ground pin. It is recommended that the instrument be grounded to protect operating personnel.

2.4.2 To preserve the protective feature of the instrument when operating from a two-contact outlet, use a two-prong adapter with the ground wire connected to a convenient ground point.

2.5 MOUNTING

2.5.1 Bench Use. The instrument is normally supplied with rubber feet and a fold-away tilt stand for convenient bench operation. The tilt stand permits raising the front of the instrument so that the dial and control markings can be read more easily.

2.5.2 Rack Mounting. To rack mount the instrument, necessary hardware including joining plates and corner brackets with handles are available from the factory upon request. Instructions for rack mounting are provided with the hardware kits.

2.6 REPACKAGING FOR SHIPMENT

2.6.1 If the instrument is to be packaged for reshipment, use the original shipping container and packaging (see Fig. 2.1). If the original packaging has been discarded or not in condition for reuse, perform the following packaging procedure:

a. Wrap the instrument in a heavy paper wrapping or plastic protective covering.

b. Place a protection cushion in the bottom of shipping carton and place the instrument on the protective cushion.

c. Surround the remaining sides and top with additional protective cushions. Place front and rear protective cushions in such a manner as to provide support of the instrument without resting on the controls or indicators.

2.7 SHIPPING METHOD

This instrument should be shipped only by truck freight, rail freight, air freight, or parcel delivery service. If it is shipped by parcel post, damage is likely to occur. Systron-Donner is not responsible for units damaged in shipment to the factory for repair, whether such units are in warranty or not.

2.8 INSURANCE

Insure the unit for full value whenever it is shipped.

2.9 RETURNS FOR REPAIR

Be sure to fully identify any instrument that is returned to Systron-Donner for repair of any kind, in-warranty or not. The paperwork with the unit must show the instrument serial number, malfunction or problem to be corrected, and the exact address to which the instrument should be returned when repairs are completed.

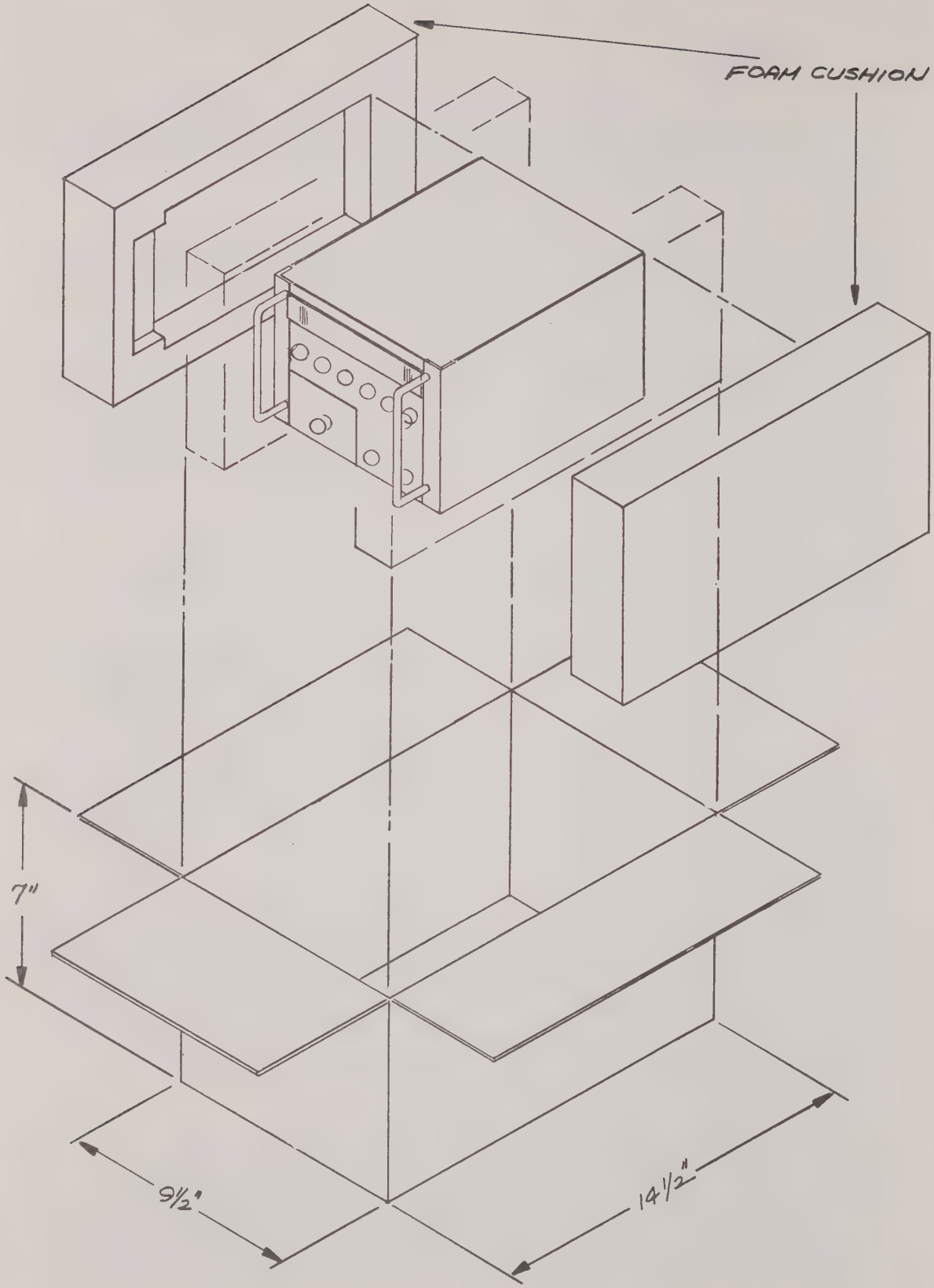


Figure 2.1 Packaging for Shipment

SECTION 3

OPERATION

3.1 INTRODUCTION

3.1.1 The Systron-Donner Model 5000A Sweeper is an ultra-stable, permanently calibrated instrument, designed to provide precisely calibrated DC and modulation voltages to operate a variety of plug-ins. Attached to each plug-in is a slide-rule dial with the appropriate graticule and markings for that particular plug-in. When the plug-in and its slide-rule dial are installed, five controls (F1-START, MARKER 1, MARKER 2-F_c, MARKER 3 and F2-STOP) and their associated color-coded dial indicators provide an easy means for precise setting of the control functions. The remaining controls on the Model 5000A Sweeper are essentially independent of the plug-ins.

3.1.2 Operation of the Sweeper with Oscillator Plug-Ins are described in this section. Operation with other type plug-ins is covered in the manual for the Plug-In. The Plug-In contains the controls and circuitry peculiar to itself, and is therefore dependent only on the Model 5000A Sweeper for its source of power and modes of operation.

3.2 FRONT PANEL CONTROLS AND OUTPUT CONNECTORS (Ref. Fig. 3.1)

3.2.1 (1) F1-START: Wide Sweep Mode - Selects sweep start and manual scan start. Setting indicated by Yellow indicator on slide-rule dial.

3.2.2 (2) MARKER 1: Wide Sweep Mode and Δ F Mode - Selects marker position. Setting indicated by Green indicator on slide-rule dial.

3.2.3 (3) MARKER 2-F_c: Wide Sweep Mode - Selects marker position: Δ F Mode- Selects center of sweep; CW Mode - Selects frequency of operation. Setting indicated by Red indicator on slide-rule dial.

3.2.4 (4) MARKER 3: Wide Sweep Mode and Δ F Mode - Selects marker position. Setting indicated by Blue indicator on slide-rule dial.

3.2.5 (5) F2-STOP: Wide Sweep Mode - Selects sweep end and manual scan end. Setting indicated by Orange indicator on slide-rule dial.

3.2.6 (6) DIAL GRATICULE: Wide Sweep Mode - Upper edge markings apply to all indicators. ΔF Mode - Upper edge markings apply to Marker 2-F_c center of sweep. Lower edge markings apply to Marker 1 and Marker 3, and indicate width of Δ F sweep when $F_c \pm \Delta F$ VERNIER is in CALIB position.

3.2.7 (7) VERNIER: Wide Sweep Mode, CW Mode, and ΔF Mode. Set at 0 for direct frequency readings on slide-rule dial. Clockwise rotation increases all

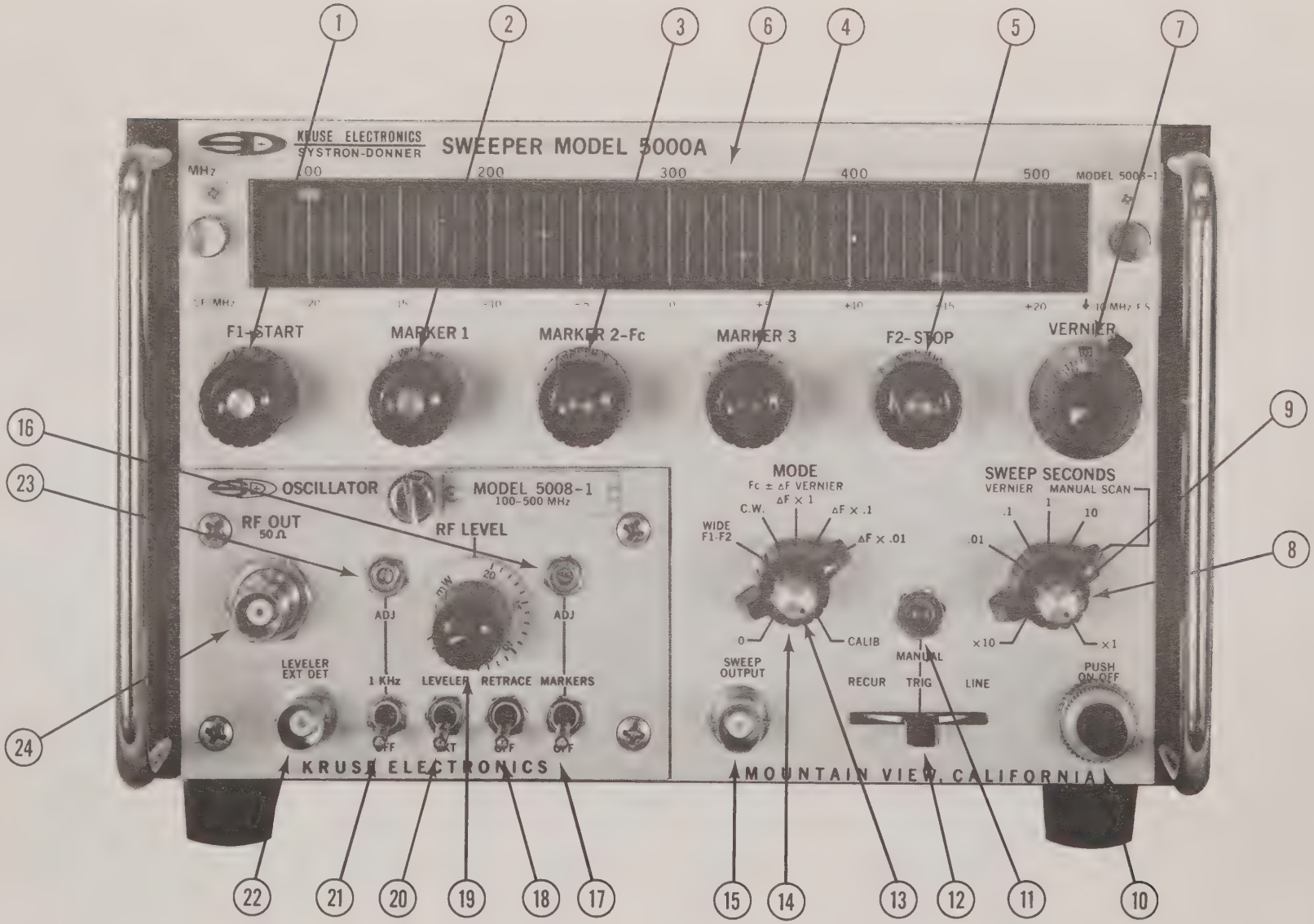


Figure 3.1 Front Panel Controls

frequencies without varying sweep width. Vernier is directly calibrated in MHz with ± 10% accuracy. Full scale range is indicated on dial graticule.

3.2.8 (8) SWEEP SECONDS: Wide Sweep Mode and ΔF Mode - Coarse sweep time in decades and selection of Manual Scan.

3.2.9 (9) VERNIER-MANUAL SCAN: With SWEEP SECONDS in .01, .1, 1 or 10 position - Fine control of sweep time. With SWEEP SECONDS in MANUAL SCAN position - Wide Sweep Mode, manual scan from F1 to F2; ΔF Mode, manual scan of selected range about Marker 2-F_c.

3.2.10 (10) PUSH ON/OFF: Push button AC power switch with indicator lamp.

3.2.11 (11) MANUAL: Push button to start Sweep when RECUR-TRIG-LINE switch is in TRIG position.

3.2.12 (12) RECUR-TRIG-LINE: Selects sweep synchronizing mode.

a. Recur - Automatic sweep recycle.

b. Trig - Single sweep initiated by either Manual push button or External Trigger.

c. Line - Automatic sweep recycle synchronized with AC power line. Useable only when sweep speed is faster than 16 mS per sweep.

3.2.13 (13) F_c ± ΔF VERNIER: ΔF Mode - Vernier control of ΔF sweep width from zero to maximum selected by MODE switch.

3.2.14 (14) MODE:

a. WIDE F1-F2 - Frequency varies from F1 to F2 plus vernier setting, regardless of direction when using Internal Sweep or Manual Scan.

b. CW - Single frequency operation, frequency selected by MARKER 2-F_c plus VERNIER setting.

c. ΔF x 1, ΔF x .1, ΔF x .01 - Frequency varies ± about MARKER 2-F_c plus VERNIER setting, when using internal sweep or Manual Scan. ΔF x 1; Maximum sweep width is indicated on graticule lower scale.

3.2.15 (15) SWEEP OUTPUT: Internal Sweep - Wide Sweep Mode and ΔF Mode, 0 V start of sweep, +10 V end of sweep. MANUAL SCAN mode, 0 to +10 V dependent on position of MANUAL SCAN knob. CW Mode, 0 V output. External Sweep Mode - Connected directly to EXTERNAL SWEEP jack. Output impedance on Internal Sweep less than 100 Ω. BNC connector.

3.2.16 (16) ADJ (MARKERS): Adjust marker amplitude of RF output.

3.2.17 (17) MARKERS: On-off switch for markers in RF output.

3.2.18 (18) RETRACE: Switches RF on or off during sweep flyback and between triggered sweeps.

3.2.19 (19) RF LEVEL: RF Output level amplitude control. Calibrated directly in milliwatts in leveled mode when proper sampler is used.

3.2.20 (20) LEVELER:
Models without internal leveling:
With appropriate external sampler-detector connected, RF output of external sampler is leveled with switch in EXT (down) position and unleveled with switch in OFF (center) position. RF LEVEL control operates normally in either switch position. With no external sampler connected, RF level cannot be adjusted with RF LEVEL control when switch is in INT (up) position or in EXT (down) position but operates normally in OFF (center) position.

Models with internal leveling:
RF output of plug-in is internally leveled with switch in INT (up) position and externally leveled with switch in EXT (down) position, providing appropriate external sampler-detector is connected. With no external sampler connected and switch in EXT (down) position, RF output is unleveled and cannot be adjusted with RF LEVEL control. RF output is unleveled when LEVELER switch is in OFF (center) position and RF LEVEL control operates normally.

3.2.21 (21) 1 KHz: Internal 1 KHz square wave RF modulation on/off switch.

3.2.22 (22) LEVELER EXT DET: Leveling signal input from crystal detector-sampler with specified sensitivity. Input impedance 5 kΩ. BNC connector.

3.2.23 (23) ADJ (1 KHz): Sets frequency of square-wave AM from 950 to 1050 Hz.

3.2.24 (24) RF OUT CONNECTOR: Oscillator RF Output. Type BNC or precision 50 Ω type N female connector. (Refer to plug-in specifications in the Systron-Donner catalogue.)

3.3 REAR PANEL CONTROLS AND CONNECTORS (Ref. Fig. 3.2)

3.3.1 (1) EXTERNAL AM: +10 V controls full amplitude range of RF unleveled, 2 V when leveled. Positive going increases output from RF Level setting. Rise and fall time, less than 2 microseconds. Input impedance 25 BNC connector.

3.3.2 (2) 1 KHz OUTPUT: +2 V square wave output when 1 KHz switch is on. Output impedance 1 BNC connector.

3.3.3 (3) PHASE LOCK: Miniature phone jack DC coupled to oscillator for phase lock control or external FM. Impedance and sensitivity varies with RF frequency in most oscillator plug-ins. (See chart in Fig. 3.3). For constant impedance and sensitivity, see Modification M6

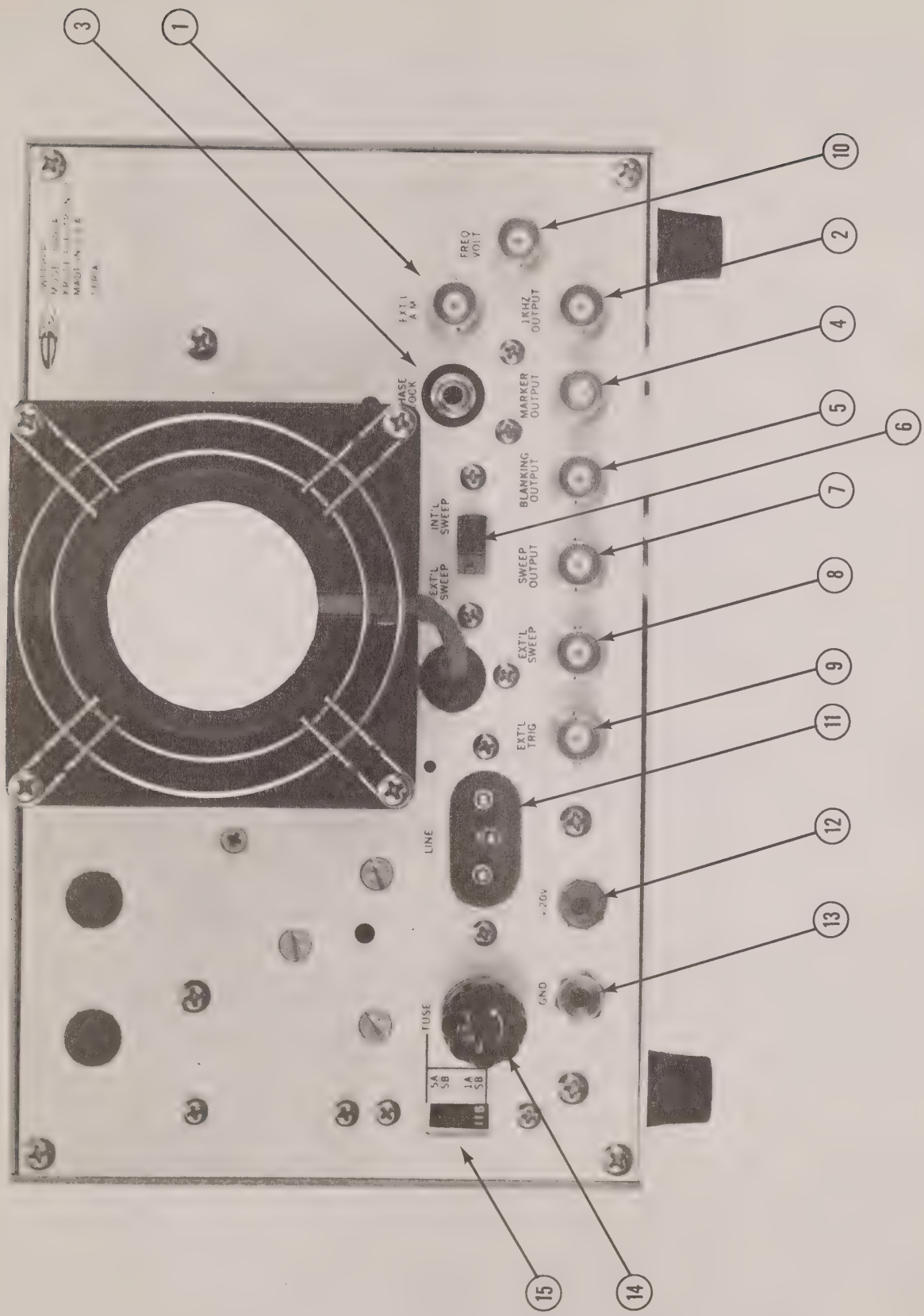


Figure 3.2 Rear Panel Controls and Connectors

3.3.4 (4) MARKER OUTPUT: Wide Mode, three - 1 V pulses; ΔF Mode, two - 1 V pulses. Output impedance 3 kΩ. BNC connector.

3.3.5 (5) BLANKING OUTPUT: +18 V during flyback used for recorder pen lift or instrumentation blanking. -0.6 V during sweep. Output impedance 1 kΩ. BNC connector.

3.3.6 (6) EXT'L SWEEP/INT'L SWEEP: External Sweep - disconnects all internal sweep circuitry and requires an External Sweep input. Both Sweep Output connectors are directly connected to External Sweep connector. Internal Sweep - Sweep provided by internal generator.

3.3.7 (7) SWEEP OUTPUT: Same as Sweep Output on front panel.

3.3.8 (8) EXT'L SWEEP: Input for External Sweep Mode. 10.0 V peak-to-peak signal sweeps full frequency range. Positive going increases RF output frequency. Response for full sweep DC to 10 Hz in CW or Manual Scan Modes: DC to 10 in all Sweep Modes. Input impedance 25 kΩ. BNC connector.

3.3.9 (9) EXTERNAL TRIG: Input triggering from an external source. +3 V minimum, 1 microsecond or longer signal will initiate sweep. Input impedance 10 kΩ. BNC connector.

3.3.10 (10) FREQ VOLTS: Output voltage proportional to RF frequency. Instantaneous voltage is proportional to frequency in all modes of operation excepting when voltage is applied to phase lock input. Phase lock plug or voltage should be removed when this signal is used to determine frequency.

3.3.11 (11) LINE: AC power input connector.

3.3.12 (12) +20 V: Precision 20 ± .01 V DC source for externally programming frequency and/or RF power. Output current 10 mA maximum. Banana jack.

CAUTION: Do not short +20 V to ground ---Damage could result.

3.3.13 (13) GROUND: Chassis ground used for common ground of equipment or in conjunction with +20 V output. Banana jack.

3.3.14 (14) FUSE 1A: Input AC power line protection, 3 AG, 1 Amp, Slo-Blo.

3.3.15 (15) 115 V/230 V SWITCH: Switch for selecting either 115 V AC or 230 V AC input power or 104 VAC or 208 VAC input power depending on internal jumper position. (Fuse should be changed to 3 AG, 1/2 Amp, Slo-Blo when 230 V or 208 V power is used).

3.4 OPERATING PROCEDURE

3.4.1 To place instrument in operation, connect power cable to AC power source and depress ON-OFF switch. The push-button lamp indicates unit is operating.

3.4.2 Internal Sweep Mode of Operation. To operate on Internal Sweep Mode, place INTERNAL/EXTERNAL sweep switch on rear panel to INTERNAL. If Phase Lock is not used, be sure the phase lock plug is removed.

a. Set the Oscillator Plug-In controls (RF LEVEL, LEVELER, 1 KHz, RETRACE and MARKER) to desired positions.

b. Select Sweep MODE desired.

1. WIDE F1-F2: Set F1-START for start frequency desired, set F2-STOP for end frequency desired. Set MARKER 1, MARKER 2-F_c, and MARKER 3 to desired frequencies. Set SWEEP SECONDS and RECUR-TRIG-LINE switch to desired position.

   With the VERNIER control at zero, all frequencies are as indicated on the slide-rule dial. Clockwise rotation of the VERNIER control adds to start and stop frequencies. Full scale range of the VERNIER control is indicated on the dial graticule.

2. CW: Set MARKER 2-F_c to frequency desired and VERNIER to zero. Clockwise rotation of VERNIER adds to MARKER 2-F_c value indicated on the slide-rule dial.

3. $\Delta F \times 1$, $\Delta F \times .1$, $\Delta F \times .01$: Set MARKER 2-F_c to center of sweep desired. Set MARKER 1 and MARKER 3 to desired frequencies using calibration on lower edge of graticule. Set SWEEP SECONDS and RECUR-TRIG-LINE switch to desired position.

   With VERNIER at zero, center of band occurs at MARKER 2-F_c setting on slide-rule dial. VERNIER rotation shifts center frequency by its reading.

   $F_c \pm \Delta F$ VERNIER controls sweep width from zero to ΔF range selected by MODE switch. With SWEEP SECONDS in MANUAL SCAN, the SWEEP SECOND VERNIER will scan the ΔF range about MARKER 2-F_c.

3.4.3 External Sweep Mode of Operation. To operate the instrument in the external mode, place the INTERNAL/EXTERNAL SWEEP switch on the rear panel to EXTERNAL SWEEP. If phase lock is not used, remove the phase lock plug.

a. Set the Oscillator Plug-In controls (RF LEVEL, LEVELER, 1 KHz, RETRACE, and MARKER) to the desired positions.

b. For response to 10 kHz set MODE switch to WIDE and set SWEEP SECONDS to .01, .1, 1 or 10. Set F1-START to frequency desired with 0 volts into rear EXTERNAL SWEEP connector, and set VERNIER to 0. To sweep up in frequency a positive going waveform is required, and to sweep down in frequency a negative going signal is required. AC waveforms will sweep ± about F1-START setting. The frequency band swept will be directly proportional to the amplitude of the external sweep waveform, i.e. 100% of band 10 V, 50% of band 5 V. F1-START, MARKER 1, MARKER 2-F_c, MARKER 3 and VERNIER all function the same as in the internal sweep mode. F2-STOP will be the only non-functioning dial control.

c. For slow signal and attenuation of noise, response to 10 Hz can be obtained by setting MODE switch to CW. MARKER 2-F_c and VERNIER now set the frequency for 0 volt input signal at the EXTERNAL SWEEP jack.

d. The +20 V and GND jacks located on the rear panel, provides a precise DC source for application to an external potentiometer to remotely vary frequency. The potentiometer should be connected from +20 V to GND with a 25 kΩ resistor inserted between the arm and EXTERNAL SWEEP input.

3.4.4 Frequency Modulation. In addition to the internal or external swept frequency modes of operation, fast, narrow-band FM can also be achieved by applying signals to the PHASE LOCK input jack. It should be remembered that a positive-going voltage applied to the PHASE LOCK input decreases frequency and a negative-going voltage increases frequency. (See Specification Chart Fig. 3.3 of ratings and characteristics.)

3.4.5 Amplitude Modulation.

a. Internal square wave modulation, 950 to 1050 Hz, may be turned on with the 1 kHz switch and frequency set by ADJ control on the plug-in panel.

b. External Modulation may be fed to rear panel connector. 0 to +10 V positive going increases output over full amplitude range in unleveled operation, +2 volts in leveled operation.

c. Markers amplitude modulate the RF output. They are controlled by MARKERS switch and associated ADJ control on front panel of the plug-in.

d. RF On/Off during sweep flyback time and between triggered sweeps may be selected with the RETRACE switch on the front panel of the plug-in.

e. RF output may be amplitude controlled to maintain a constant output by sampling the RF output and feeding amplitude information into the LEVELER INPUT connector. Typically, a directional coupler and a crystal detector will provide the signal required. The RF LEVEL control is calibrated for use with a sampler-detector having a -10 mV/mW output.

Plug-in Model	*Approximate Impedance (1) (2)*	*Approx. Sensitivity*	*Approx. Response*	*Maximum Deviation*	*Maximum Ratings(3)*
5007	10 kΩ, 200 pF	0.5 to 5 MHz/V	30 kHz	± 50 MHz	40 V/2 mA
5008	100 Ω to 10 M Ω, 200 pF	5 to 15 MHz/V	1 MHz	± 100 MHz	40 V/2 mA
5008-1	100 Ω to 10 M Ω, 200 pF	2 to 40 MHz/V	5 MHz	± 200 MHz	40 V/2 mA
5010	20 Ω to 10 M Ω, 150 pF	1 to 20 MHz/V	15 MHz	± 250 MHz	60V/10 mA
5011	20 Ω to 10 M Ω, 150 pF	2 to 60 MHz/V	15 MHz	± 500 MHz	60V/10 mA
5012	20 Ω to 10 M Ω, 150 pF	5 to 70 MHz/V	15 MHz	± 500 MHz	60V/10 mA
5013	20 Ω to 10 M Ω, 150 pF	5 to 170 MHz/V	30 MHz	± 1000 MHz	60V/10 mA
5013-3	1 K to 10 M Ω, 150 pF	6 to 22 MHz/V	30 MHz	± 250 MHz	60V/10 mA
5014-1	1 K to 10 M Ω, 150 pF	11 to 28 MHz/V	30 MHz	± 250 MHz	60V/10 mA
5014	0.5 Ω, 50 pF	200 kHz/mA	200 kHz	± 200 MHz	1V/1A
5015	0.5 Ω, 50 pF	100 kHz/mA	200 kHz	± 1000MHz	1 V/1A
5016	0.5 Ω, 50 pF	100 kHz/mA	200 kHz	± 100 MHz	1V/1A

(1) Driver source impedance required is less than 50 Ω on all models except 5014, 5015, and 5016.

(2) Series resistance, shunt capacitance.

(3) Maximum voltage/Maximum current.

Figure 3.3 Phase Lock Input Specification Chart

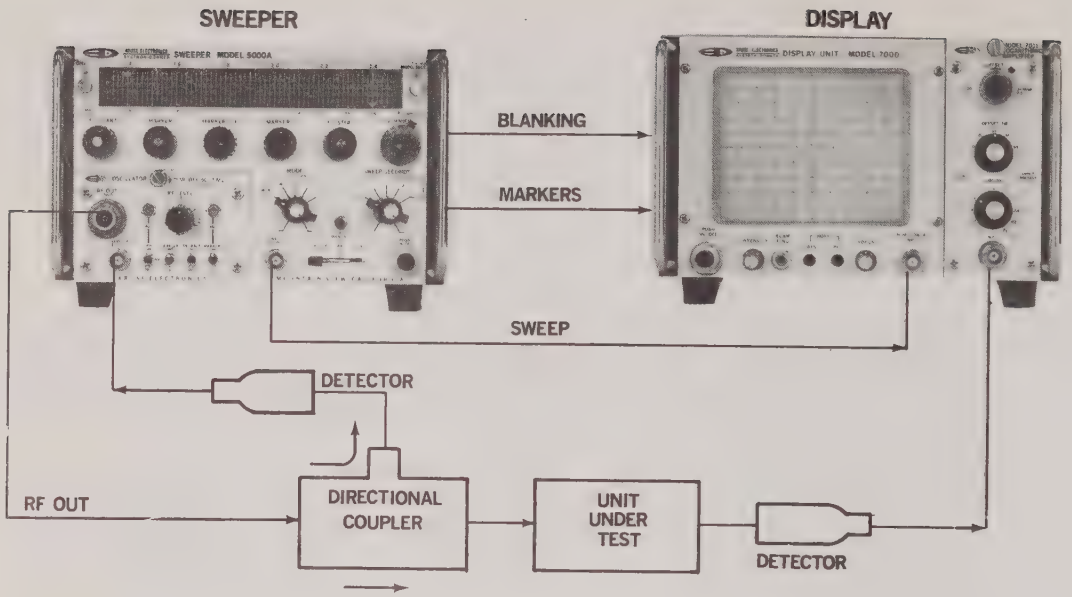


Figure 3.4 Typical Test Setup for Measurement of Transfer Characteristics

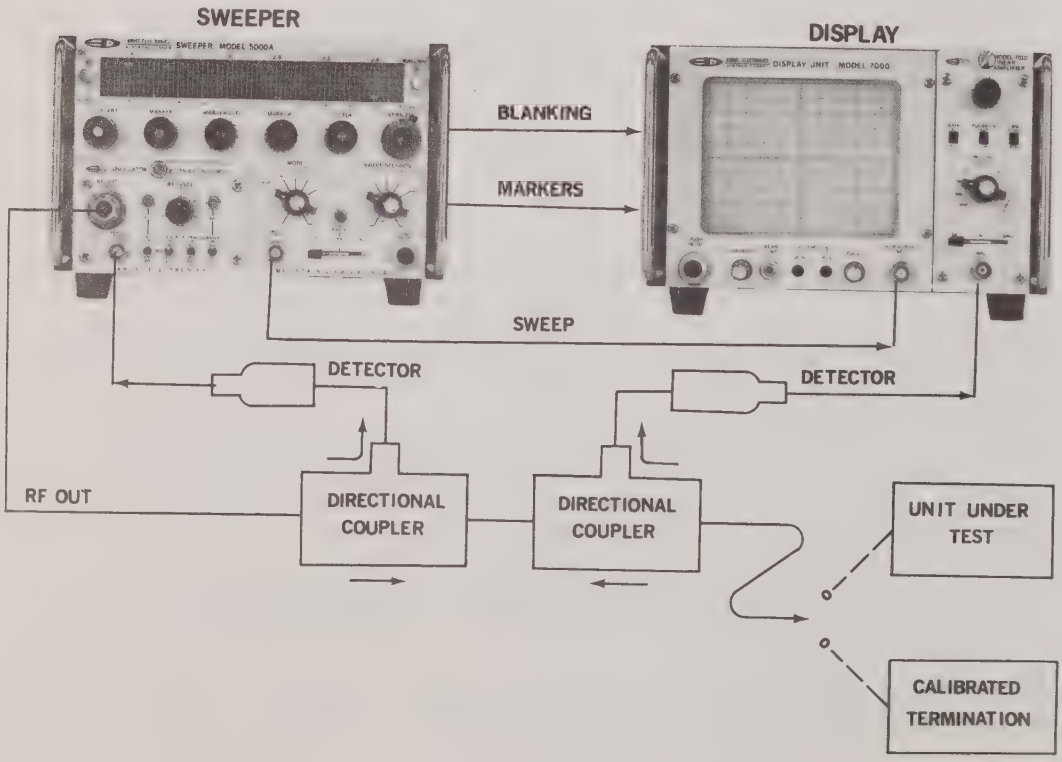


Figure 3.5 Typical Setup for Reflected Power and VSWR Measurements

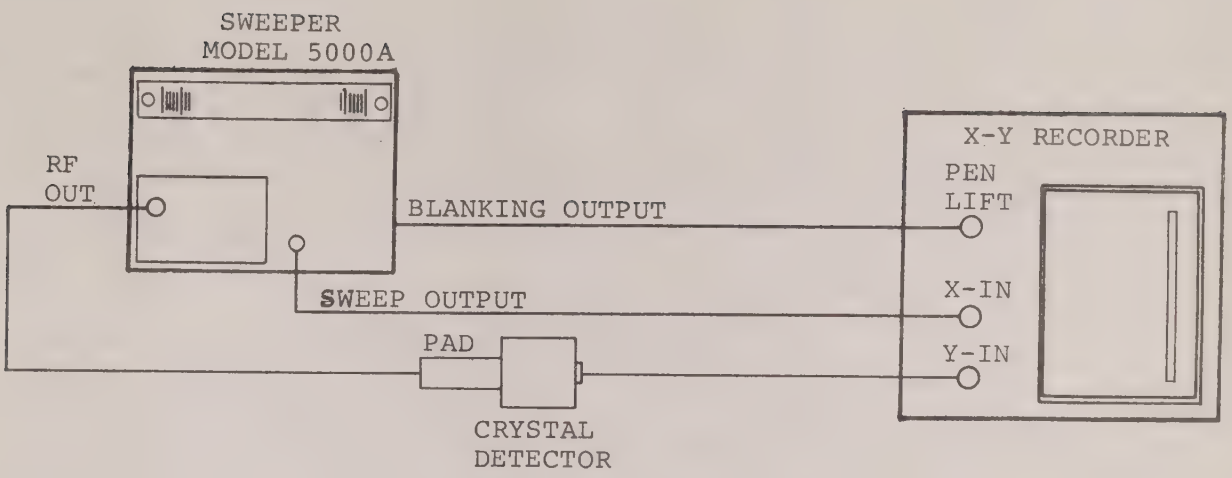


Figure 3.6 Typical X-Y Recorder Set-up to Plot Sweep Oscillator Power Output Characteristics

3.5 QUIETING CIRCUIT

To reduce noise and increase stability of the RF output signal, the bandwidth of the oscillator tuning input in the RF plug-in is automatically reduced when the 5000A MODE switch is set to CW or when the SWEEP SECONDS switch is set to MANUAL SCAN.

Because this quieting circuit is activated in Manual Scan mode, the starting and stopping frequencies set in Manual Scan will not correspond exactly with the frequencies in another sweeping mode of operation. The following procedure should be followed to modify the 5000A so that the quieting circuits will not be enabled when the SWEEP SECONDS switch is set to MANUAL SCAN.

After this modification has been incorporated, frequency shift between Manual Scan and any of the other sweeping modes (Wide F_1 - F_2 or ΔF) will be minimal.

a. Unplug the power cord and remove the top cover and left side cover (near PUSH ON/OFF switch) of the 5000A.

b. Locate printed circuit board A9 (subassembly 950168). A9 is located directly in front of the first plug-in printed circuit board, which has three large black capacitors mounted on it. A9 is not a plug-in board.

c. Locate Zener diode CR3 (1N5245) as shown in Figure 6.9 in Section 6 of this manual.

d. Clip either lead of the diode, or unsolder it from the circuit board (you will have to remove the bottom cover to unsolder it).

e. Be sure that the loose lead from CR3 is not near or touching anything.

f. No calibration adjustments are required after these operations.

g. Replace any covers removed in steps a or d.

A slight anomaly present in all 5000A sweepers will show up after this modification has been made; due to oscillator hysteresis and other factors, there is a tendency for the start and stop frequencies to shift slightly as the sweeping speed is changed. To ensure that this does not affect measurements, calibrate chart recorders and other devices at the same sweep speed which is to be used for the measurement.

SECTION 4

THEORY OF OPERATION

4.1 INTRODUCTION

4.1.1 The S-D Model 5000A Sweeper, can be most easily understood by dividing it into its three basic sections:

a. Stable Power Supplies
b. Modulation Techniques
c. Modulation Generators

The use of an Oscillator Plug-In will be assumed to facilitate understanding the purpose of the unique approach used in the Model 5000A Sweeper.

Reference to Figure 4.1, Simplified Schematic and Figure 6.1, the complete schematic for the Model 5000A Sweeper will aid to understanding the operation and outputs of the various circuits to be discussed.

4.1.2 The wide variety of Plug-Ins adaptable to the Model 5000A Sweeper will be described separately in their respective manuals. At this time, only a typical Oscillator Plug-In will be incorporated to facilitate understanding the circuit theory of the Model 5000A Sweeper.

4.2 STABLE POWER SUPPLIES

4.2.1 The three transformer powered, highly filtered, rectifier circuits supply the necessary DC input to the regulator circuits. The output voltages available are nominally ±20 V, +30 V and +250 V.

4.2.2 A reference zener diode, A1CR1, is used in the +20 V regulator to achieve an extremely accurate reference voltage. The +20 V, +30 V, and -20 V regulators use similar high-gain, stabilized differential amplifiers to accomplish the necessary regulation. Both the +30 V and -20 V supply use the +20 V for their reference source and, therefore, their output voltage depends upon the setting and stability of the +20 V supply.

4.2.3 The outputs of the regulated +20 V, +30 V, -20 V, and unregulated +250 V are connected directly to J-20, the Plug-In mating connector. The +20 V, +20 V, +30 V, and -20 V are used by the control circuitry within the Model 5000A Sweeper.

4.3 MODULATION TECHNIQUES

4.3.1 The four outputs other than DC power, from the Sweeper/Modulator to the Plug-In are:

a. FM: Sweep, CW and Vernier Circuitry output
b. Quieting: 0 or +5 V from Sweep Circuitry
c. Blanking: Pulse from Sweep Circuitry
d. Markers: Marker Circuitry output

4.3.2 Wide Sweep Mode (F1 to F2) - Mode Switch position #1

a. Section C of MODE switch enables the sweep generator circuits to produce a linear sawtooth waveform, 0 to +10 V with flyback time less than 10% of rise time, and a blanking pulse of +18 V during the flyback time.

b. The sawtooth sweep waveform is fed through the INTERNAL/EXTERNAL SWEEP switch, section A, to the F2-STOP control and through MODE switch, section H to Summing Amp #2 input #1. The output of F2-STOP is fed through MODE switch, Section E and INTERNAL/EXTERNAL SWEEP switch, Section C to Summing Amp #1 input #1.

The output from Amp #2, a highly stable DC inverting amplifier with unity gain, is a +10 to 0 V sawtooth and is applied to F1-START control. The output of F1-START is then fed through MODE switch, Section D to Summing Amp #1 input #2.

c. The inputs #1 and #2 of Summing Amp #1 are summed together to form the following outputs at Summing Amp #1 output #4.

1. F1 at min, F2 at max: Output 0 to - 10 V sawtooth.
2. F1 at max, F2 at min: Output - 10 to 0 V sawtooth.
3. F1 at min, F2 at min: Output 0 V DC.
4. F1 at max, F2 at max: Output - 10 V DC.

Since the summing action is arithmetic, the output of Amp #1 will be a sawtooth with a start voltage set by F1-START and end voltage set by F2-STOP. The sums of these two quantities will always be in the range 0 to - 10 V. Input #3 of Amp #1 is connected through the Plug-In to the Vernier control, and allows a DC offset to be inserted. This offset will also be arithmetically added to inputs #1 and #2 allowing fine control of sweep position. Calibration of the VERNIER control is set by the resistors in the Plug-In.

d. The output of Amp #1 is fed directly to the Plug-In, and through MODE switch, Section A, to the marker generator.

e. In external sweep, EXTERNAL/INTERNAL SWEEP switch Section A, kills the internal sweep generator. Section B connects the external sweep input to the sweep output, and Section C connects Amp #1 input #1 directly to the EXTERNAL SWEEP input jack. The output of the sweep generator is 0 V and the output of Amp #2 is +10 V, allowing the F1-START voltage to be summed with the external sweep input. This allows the F1-START control to function normally and the external sweep input to replace the F-2 STOP control. Vernier operation remains the same.

4.3.3 CW Mode: Mode Switch position #2

a. Section D of MODE switch connects MARKER 2-F_c through the 2:1 voltage dropping resistors to input #2 of Summing Amplifier #1. Summing Amplifier #1 is a highly stable inverting DC Amplifier with unity gain. Summing Amplifier #1 output #4 is therefore equal and opposite to the input, or 0 to -10 V as MARKER 2-F_c is moved from minimum to maximum.

b. Vernier is also fed into Summing Amplifier #1 and adds to the voltage as set by MARKER 2-F_c. Input #1 of Summing Amplifier #1 is connected to ground in internal sweep or to the external sweep connector in external sweep. An input to the EXTERNAL SWEEP jack will add to or subtract from MARKER 2-F_c and Vernier settings.

c. MODE switch Section A insures that the internal sweep circuits are killed by supplying a +6 V to "CW trigger kill" and "Quieting line" to Plug-In. MODE switch Section A also kills markers and Section F applies ground to Blanking.

4.3.4 Δ F MODE - MODE switch positions #3, #4, and #5

a. In the Δ F MODE, the sweep generator operates the same as in the wide sweep mode. The 10 volt sweep is applied to Amplifier #6 input. This amplifier offsets the sweep 5 volts so that a non-inverted -5 volt to +5 volt sweep is available at Amplifier #7 output. This is applied to the $F_c \pm \Delta F$ vernier potentiometer. Decade divider resistors connected to the terminals of MODE switch, Section E and the vernier pot attenuate this signal so that with the ΔF vernier control fully CW, the sweep voltages appearing at the arm of Section E are:

Position #3:	-0.5 V to +0.5 V
Position #4:	-0.05 V to +0.05 V
Position #5:	-0.005 V to +0.005 V

These voltages are connected through the INTERNAL/EXTERNAL SWEEP switch, Section C, to Amp #1, input #1.

b. MARKER 2-F_c output is connected through MODE switch, Section D to Amp #1, input #2. The output of Amp #1 is the sum of MARKER 2-F_c and the attenuated ± sweeps. With the ΔF Vernier at minimum setting, the output of Amp #1 is a DC voltage determined by the setting of MARKER 2-F_c. As the ΔF Vernier is increased, The ± ΔF sawtooth is added to the DC voltage from MARKER 2-F_c. The amplitude of the ΔF sweep is determined by the ΔF Vernier and MODE switch position. Input #3 of Amp #1 is connected through the Plug-In connector to the Vernier control allowing a DC offset to be inserted. This offset will also be arithmetically added to inputs #1 and #2 of Amp #1 allowing fine control of the sweep center.

c. The output of Amp #1 is connected only to the plug-in in the ΔF Mode. The arm of the $F_c \pm \Delta F$ vernier potentiometer is connected to Amplifier #2 input 1 through Mode switch, Section H. Mode switch, Section F, changes the offset applied to Amp #2 so that the output of Amp #2 is always in the 0 to - 10 V range. This is applied to the Marker Generator through Mode switch, Section A. In this configuration, Markers are independent of MARKER 2-F_c setting, but dependent on $F_c \pm \Delta F$ Vernier setting such that Marker calibration is maintained for any ΔF width.

d. In External Sweep, the ΔF mode of operation is similar to the Wide F1 to F2 mode with the following exceptions:

1. MARKER 2-F_c replaces the function of F1-START.
2. No markers are available.

4.4 MODULATION GENERATORS

4.4.1 The Sweep Generator consists of Amp #3, Trigger #1, Flip-Flop #1. Timing Capacitors, and associated controls.

a. Amp #3 is a high-gain operational amplifier connected as a Miller Integrator. The amplifier maintains a constant current at its summing junction and consequently, develops a linear rise in voltage across the sweep timing capacitor selected by Section A of the SWEEP SECONDS switch.

b. When the increasing voltage reaches the pre-set voltage of +10 V, Flip-flop #1 triggers, producing a +18 V output. This pulse is fed to the Blanking output and to the input of Amp #3, causing the sweep capacitor to discharge. Automatic recycle (Recur) is accomplished by feeding the output of the amplifier through SWEEP SECONDS switch, Section C, RECUR switch, Section B, MODE switch, Section C and to the input of Flip-flop #1. When the output of Amp #3 drops to 0 V, Flip-flop #1 is reset, removing the +18 V from the input of Amp #3, allowing it to recharge the sweep capacitor.

c. With the RECUR-TRIG-LINE switch in the TRIG or LINE position, the feed-back loop to the Flip-flop is removed. RECUR-TRIG-LINE switch, Section A, selects the input trigger from the EXTERNAL TRIG jack or Manual push-button in position 2 or the AC line in position 3, to enable Trigger #1 to reset the Flip-flop.

d. In Manual Scan, the Flip-flop is flipped to the +18 V (blanking) output condition. When the SWEEP SECONDS switch is being switched to the MANUAL SCAN position, the brief opening of the contacts of SWEEP SECONDS switch, Section A, causes Amp #3 output to jump to +10 V, triggering the Flip-flop.

In the MANUAL SCAN position, SWEEP SECONDS switch, Section C, also feeds +20 V through the 15 volt zener diode and isolation diode to supply approximately +5 V to the Quieting line. Amp #3 is converted to a DC amplifier, by replacing the sweep timing capacitor with a feedback resistor (SWEEP SECONDS, Section A, position 5). In this condition, varying the VERNIER MANUAL SCAN control will produce 0 to +10 V at the sweep generator output as in the Sweep Mode.

4.4.2 The three Marker Generators are identical circuits, each consisting of a two-stage high-gain differential Amplifier.

a. The MARKER 1, MARKER 2, and MARKER 3 controls are each connected directly to the input of the respective marker generator. The sweep is connected to a second input on each generator. In the CW mode, the sweep is removed and in the ΔF Mode, MARKER 2 control is disconnected.

b. Because of the high-gain, the marker generator is normally in saturation. The sum of the voltages from a Marker Control and Sweep input passes through a coincidence point, then into saturation in the opposite direction. This switch-over transient forms the triangular marker pulse and is coupled out through a diode with all three outputs connected together.

c. Marker pulses are fed to the Marker output jack on the rear panel and to the Plug-In.

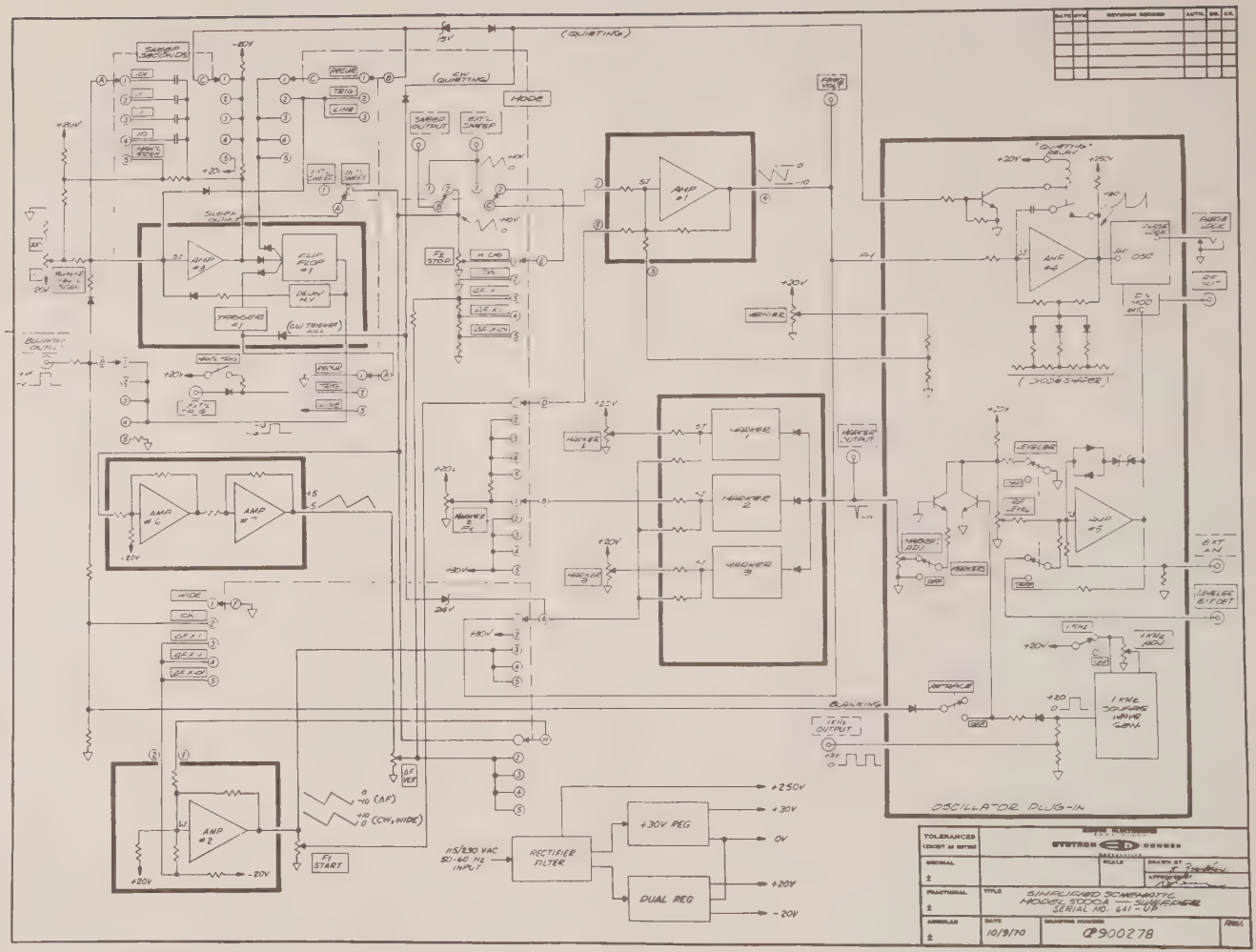


Figure 4.1 Simplified Schematic

SECTION 5

CALIBRATION AND MAINTENANCE

5.1 GENERAL

5.1.1 The S-D Model 5000A is a permanently calibrated instrument and should give many years of trouble-free operation. Routine, simple tests can be made periodically to give assurance that the instrument is accurately calibrated and operating properly. This section of the manual describes these tests.

The select-by-test components which were installed at the factory to calibrate the unit are called out within these procedures. If any parameter proves to be outside the specified range, the calibration components may be replaced.

Repairs or calibration accuracy checks should be undertaken only by qualified personnel with sufficient experience and knowledge to ensure that proper test methods are employed. Use standard maintenance practices when working on the instrument. Always turn line power off before removing PC boards, or otherwise working on the instrument. Discharge large filter capacitors before performing repairs.

5.1.2 Care should be taken in removing and replacing components to prevent damage to printed wiring, cabling and adjacent components. The use of a low-power, pencil-type soldering iron is recommended. DO NOT use a soldering gun as damaging voltages may be induced into solid-state components.

5.2 PREVENTATIVE MAINTENANCE

5.2.1 The Model 5000A Sweeper and its various RF plug-ins require no periodic maintenance when operated in a normal laboratory environment. For more severe environmental use, it is recommended that the instrument be periodically inspected and cleaned, as follows:

a. The top, bottom and side covers should be removed and any accumulated dust or foreign material removed with a soft brush and low-pressure dry air.

b. Contact fingers of plug-in PC cards may be cleaned with a gum eraser to insure good contact.

c. Inspect for loose screws, nuts, controls, etc., and tighten as required.

5.3 CALIBRATION

5.3.1 The Model 5000A Sweeper is permanantly calibrated at the factory by the selection of fixed components. No calibration adjustments are provided or required. Only a component failure can cause degradation in performance.

5.3.2 The test procedures outlined in paragraphs 5.3.5 through 5.3.9 were used to test and calibrate the instrument at the factory.

5.3.3 To achieve greater accuracy and ease of testing, this procedure emphasizes the accurate measurement of all modulation voltages supplied to the RF oscillator plug-in. Then, in the plug-in test procudure, the oscillator frequency is accurately measured in the CW mode of operation where the desired accuracy can be achieved with a frequency counter. These combined tests prove (1) that the correct tuning (modulating) voltages are applied to the oscillator from the Sweeper main frame and (2) the voltage tuned oscillator in the plug-in produces the correct frequency for specific tuning voltages throughout its range. This method of check-out also insures that different oscillator plug-ins will operate correctly in the Model 5000A Sweeper mainframe. Calibration tests for plug-ins are included in the plug-in manual.

5.3.4 For a complete check-out of the Model 5000A Sweeper, the following test equipment is required:

a. Digital Voltmeter (DVM) with 0.01% accuracy and 0.1 mV resolution (Systron-Donner Model 7004A or equivalent).

b. Oscilloscope with calibrated vertical sensitivity of 10 μV/cm, selectable bandwidth and calibrated time base (Tektronix 547 with 1A7A plug-in, or equivalent).

c. Stop watch or watch with sweep second hand.

5.3.5 Preliminary Statements

a. TESTS SHOULD BE PERFORMED IN THE SEQUENCE GIVEN, IF CALIBRATION ADJUSTMENTS ARE REQUIRED.

b. ALL TESTS SHOULD BE PERFORMED WITH THE OSCILLATOR PLUG-IN REMOVED AND THE VERNIER CONTROL SET AT ZERO.

c. See Section 3 (Figures 3-1 and 3-2) for location of controls and connectors.

5.3.6 +20 Volt Power Supply

a. Turn the line power on. With the DVM, measure the voltage between the +20 V output connector on the rear panel and chassis ground. The voltage should be +20 ± .02 V (obtained by selecting the value of A5R6 and/or A5R8).

b. Vary AC line voltage plus and minus 10% and measure the voltage change with the DVM. The voltage change should be less than ± .002 volts (Regulation < .01%).

c. Connect the oscilloscope to the +20 V jack and measure ripple. Use 1 Hz to 30 kHz bandwidth. Ripple should be less than 200 μV peak-to-peak.

5.3.7 Sweep Generator

a. Set the Model 5000A controls as follows:

MODE----------WIDE F1-F2
SWEEP SECONDS---------- .01
SWEEP SECONDS VERNIER---- center of rotation
RECUR/TRIG/LINE---------- TRIG
INT'L SWEEP/EXT'L SWEEP - INT'L SWEEP

With the DVM, measure the voltage at the SWEEP OUTPUT jack. The voltage should be 0 ± 40 mV (obtained by selecting the value of A9R7).

b. Connect the oscilloscope to the SWEEP OUTPUT jack. Depress the MANUAL trigger button and observe that a single sweep occurs each time this button is depressed.

c. Apply a 3 volt pulse from a battery or power supply to the EXTERNAL TRIGGER input jack and observe that this square-wave will initiate the sweep.

d. Set the RECUR-TRIG-LINE switch to the LINE position and observe that sweeps are initiated synchronously with the AC line frequency.

e. Set the RECUR-TRIG-LINE switch to RECUR and measure the sweep start voltage at the SWEEP OUTPUT jack with the oscilloscope. The voltage at the start of the sweep should be 0 ± 40 mV (obtained by selecting the value of A9R9).

Measure the amplitude of the sweep end voltage. The voltage should be 10 ± .04 volts (obtained by selecting the value of A2R28 and/or A2R29).

f. Set the SWEEP SECONDS switch to MANUAL SCAN. With the SWEEP SECONDS VERNIER - MANUAL SCAN control fully counter-clockwise measure the voltage at the SWEEP OUTPUT jack with the DVM. The voltage should be 0 ± 100 mV (obtained by selecting the value of A9R4)

Set the SWEEP SECONDS VERNIER - MANUAL SCAN control fully clockwise and measure the voltage at the SWEEP OUTPUT jack. This voltage should be +10 ± 0.1 volts (obtained by selecting the value of A9R6).

g. Set the RECUR-TRIG-LINE switch to RECUR. With the oscilloscope connected to the SWEEP OUTPUT jack, measure the sweep time for each of the 4 positions of the SWEEP SECONDS switch and with the SWEEP VERNIER in both the x1 and x10 position. Use the calibrated sweep of the oscilloscope to measure short time periods and the stop watch to measure longer time periods. Controls should provide coverage of sweep times from .01 to 100 seconds. Also, measure retrace time. Retrace time should be about 0.1 times the SWEEP SECONDS setting.

5.3.8 Operational Amplifiers

a. Set the MODE switch to the CW position, vary the MARKER 2-F_c control from full counter-clockwise to full clockwise while measuring the voltage at the FREQ VOLTS jack on the rear panel with the DVM. The voltage should vary from 0 ± 40 mV to -10 ± .04 V proportional to the position of the MARKER 2-F_c control.

b. Set the MODE switch to WIDE F1-F2 and the RECUR-TRIG-LINE switch to TRIG. Vary the F1-START control from full counter-clockwise to full clockwise. The voltage should vary from 0 ± 40 mV to -10 ± .04 V proportional to the position of F1-START control.

c. Set the Model 5000A Controls as follows:

SWEEP SECONDS----------MANUAL SCAN
VERNIER MANUAL SCAN----- fully clockwise
RECUR-TRIG-LINE----------RECUR

Vary the F2-STOP control from full counter-clockwise to full clockwise. The voltage should vary from 0 ± 40 mV to -10 ± .04 V proportional to the position of the F2-STOP control.

d. Set the Model 5000A controls as follows:

MODE----------ΔF x 1
SWEEP SECONDS--------- MANUAL SCAN
$F_c \pm \Delta F$ VERNIER-------- fully counter-clockwise

Measure voltage at the FREQ VOLTS jack with the DVM and adjust MARKER 2-F_c for exactly -1.000 volt. Turn the $F_c \pm \Delta F$ VERNIER to the full clockwise position. Vary the MANUAL SCAN control from full counter-clockwise to full clockwise and measure the voltage at the FREQ VOLTS jack. The voltage

should vary from -0.5 ± .005 V to -1.5 ± .005 V proportional to the position of the MANUAL SCAN control.

e. Set the MODE switch to ΔF x .1 position and repeat Step d. above. The voltage should vary by 100 ± 3.0 mV peak to peak.

f. Set the MODE switch to the ΔF x .01 position and repeat Step d. above. The voltage should vary by 10 ± 0.3 mV peak to peak.

g. Set the MODE switch to the CW position. Vary the MARKER 2-F_c control through its range and measure the noise at the FREQ VOLTS jack with the oscilloscope. Noise at the power line frequency should be less than 70 μV peak to peak and with an oscilloscope bandwidth of 1 Hz to 30 kHz should be less than 200 μV peak to peak.

5.3.9 Marker Generator and Blanking

a. Set the MODE switch to WIDE F1-F2, and the RECUR-TRIG-LINE switch to RECUR. Connect the oscilloscope and a 10 kΩ resistor to the MARKER OUTPUT connector on the rear panel and measure the amplitude of the three markers. Amplitude should be greater than 1.0 volt and Marker 2 should be about 20% higher than Markers 1 and 3.

b. Connect the oscilloscope to the BLANKING output jack on the rear panel and measure the amplitude of the blanking pulse. Blanking pulse should be +18 to 20 volts. (Polarity is reversed on units with M 1 Modification).

c. Set the Model 5000A Controls as follows:

MODE----------WIDE F1 - F2
F1 - START---------- fully counter-clockwise
F2 - STOP---------- fully clockwise
SWEEP SECONDS---------- MANUAL SCAN

Measure Marker position according to the following instructions:

1. Set each Marker, one at a time, to the following three points on the dial:

Point 1: Exactly three inches to the left of center (corresponding to the first graticule mark for all standard plug-ins).
Point 2: Center of dial (zero on lower graticule scale).
Point 3: Exactly three inches to the right of center (corresponding to the last graticule mark for all standard plug-ins).

2. While monitoring the DC output of the MARKER OUTPUT jack with the oscilloscope (DC coupled), adjust the MANUAL SCAN control to the exact tip of the positioned marker and measure the voltage at the SWEEP OUTPUT jack with DVM. The voltages for the three points should be:

Point 1: +0.1 ± .05 volts
Point 2: +5 ± .05 volts
Point 3: +9.9 ± .05 volts

d. Set the Model 5000A Controls as follows:

MARKER 2-F_c ----------precisely zero on lower graticule scale
$F_c \pm \Delta F$ VERNIER---------- fully clockwise
MODE---------- ΔF x 1

Measure position of MARKER 1 and MARKER 3 as called out in 5.3.9c above. The voltages should be as listed in the above paragraph.

SECTION 6

PARTS LISTS AND DRAWINGS

6.1 INTRODUCTION

This section contains lists of electronic parts used in the 5000A, the schematic diagram for the unit, and an assembly drawing; information is arranged in the following order:

A1 P.C. Assembly (Timing Capacitor) Parts List	Page 6-2
A2 P.C. Assembly (Trigger Sweep) Parts List	Page 6-2
Figure 6.1 A1 Timing Capacitor Board Assembly	Page 6-3
Figure 6.2 A2 Trigger Sweep Board Assembly	Page 6-4
A3 P.C. Assembly (Operational Amplifier) Parts List	Page 6-6
Figure 6.3 A3 Operational Amplifier Board Assembly	Page 6-7
Figure 6.4 A4 Triple Marker Board Assembly	Page 6-8
A4 P.C. Assembly (Triple Marker) Parts List	Page 6-9
A5 P.C. Assembly (Dual Precision Regulator) Parts List	Page 6-10
Figure 6.5 A5 Dual Precision Regulator Board Assembly	Page 6-11
Figure 6.6 A6 Single Precision Regulator Board Assembly	Page 6-12
A6 P.C. Assembly (Single Precision Regulator)	Page 6-13
A7 P.C. Assembly (Power Supply) Parts List	Page 6-14
Figure 6.7 A7 Power Supply Board Assembly	Page 6-15
Figure 6.8 A8 Operational Amplifier Board Assembly	Page 6-16
A8 P.C. Assembly (Operational Amplifier) Parts List	Page 6-17
Figure 6.9 A9 Sweep-Signal Board Assembly	Page 6-19
Figure 6.10 A10 Overcurrent Board Assembly	Page 6-20
A10 P.C. Assembly (Overcurrent) Parts List	Page 6-21
A11 P.C. Assembly (Extender) Parts List	Page 6-21
Chassis-Mounted Electronic Parts	Page 6-22
Figure 6.11 Schematic Diagram	Page 6-25
Figure 6.12 Assembly Drawing	Page 6-27

6.2 REPLACEMENTS

Many replacement parts for the plug-in are available locally, but needed parts can be ordered from the Service Division of Systron-Donner Corporation at the address shown on the service card at the front of this manual.

Be sure to give the complete reference designation for all parts ordered; this would comprise the instrument model number, board upon which the part is located, and component number. Therefore, capacitor C5 on Board A1 must be referred to as 5000AA1C5. Also include the S-D part number of the required component, if known, and the serial number of the instrument for which the part is required (the serial number is stamped on the rear panel).

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A1	950001	950001	S-D Timing Capacitor P.C. Board Assembly
A1C1	157800	212A1C103J	Electro Cube Capacitor, Mylar, .01 MFD, 200V
A1C2	157801	212A1C104J	Electro Cube Capacitor, Mylar, 0.1 MFD, 200V
A1C3	157802	212A1C105J	Electro Cube Capacitor, Mylar, 1 MFD, 100V
A1C4	157803	212A1C106J	Electro Cube Capacitor, Mylar, 10 MFD, 100V
A1TB1	936030	936030	S-D Blank P.C. Board
A2	950278	950278	S-D Trigger-Sweep P.C. Bd. Assy.
A2C1	155515	DM15-471J	Elmenco Capacitor, Mica 470 PF, 500V
A2C2	157002	192P1039R8	Sprague Capacitor, Mylar .01 MFD, 80V
A2C3	157010	192P10292	Sprague Capacitor, Mylar .001 MFD,200V
A2CR1	480014	IN3716	General Electric, Diode
A2CR2 thru CR14	480004	IN4446	Sylvania Diode
A2Q1	485047	3N138	RCA Transistor, FET
A2Q2, Q4 Q11 thru Q13	485004	2N2102	RCA Transistor
A2Q3	485005	2N2635	Motorola Transistor
A2Q5	485041	2N3933/2N5179	RCA Transistor
A2Q6, Q9	485040	2N5087	Motorola Transistor
A2Q7, Q8	485006	2N3391	General Electric Transistor
A2Q10	485021	2N2102/2N3053	S-D Selected RCA Transistor
A2R1	471458	C-4	Corning Resistor, Metal Film 12K, 1/4W, 2%
A2R2, R6	471448	C-4	Corning Resistor, Metal Film 4.7K 1/4W, 2%
A2R3	471444	C-4	Corning Resistor, Metal Film 3.3K, 1/4W, 2%
A2R4	471408	C-4	Corning Resistor, Metal Film 100 ohm, 1/4W, 2%

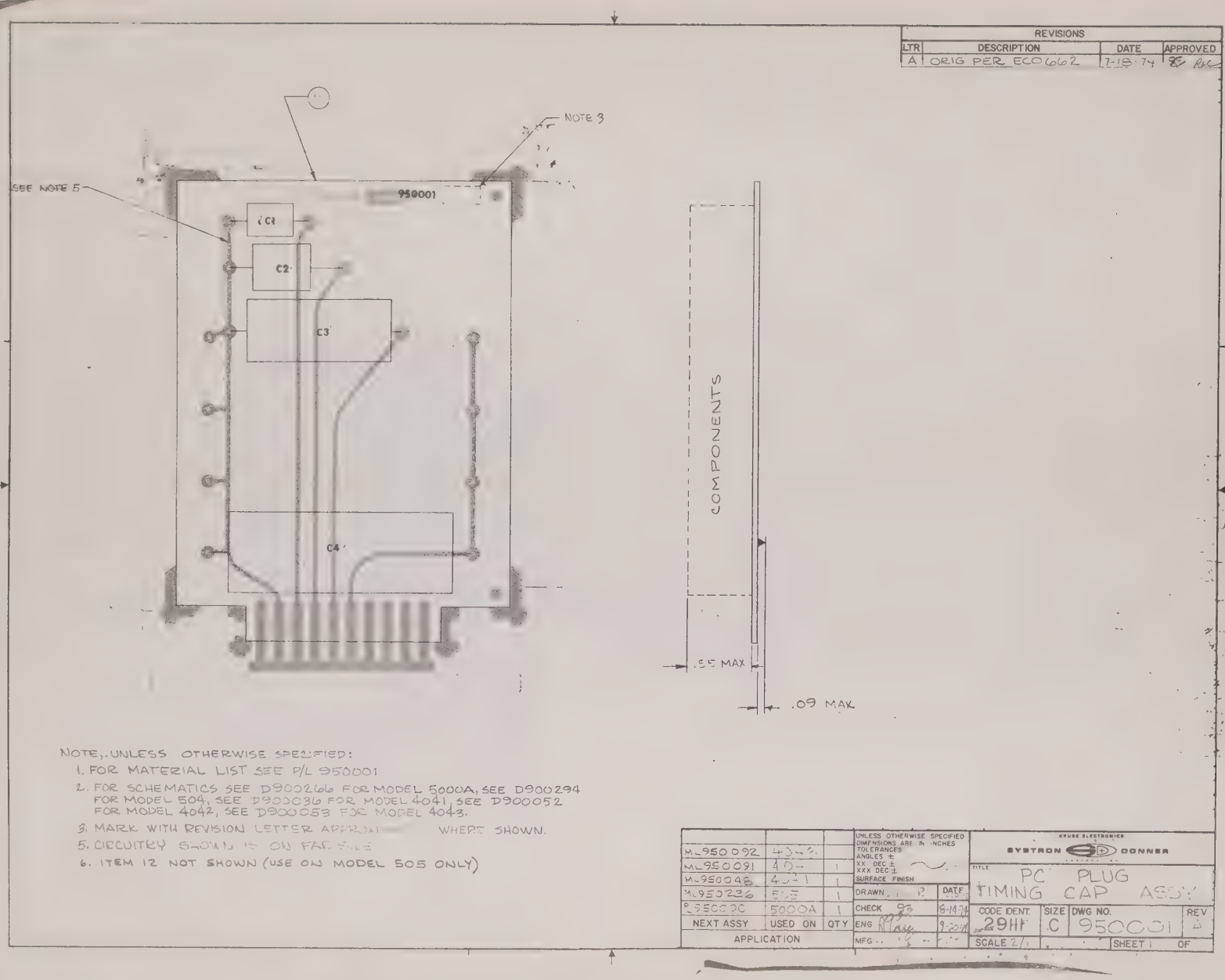

REVISIONS
LTR DESCRIPTION DATE APPROVED
A ORIG PER ECO662 7-19-74
NOTE 3
SEE NOTE 5
950001
C1
C2
C3
C4
COMPONENTS
.05 MAX
.09 MAX
NOTE, UNLESS OTHERWISE SPECIFIED:
1. FOR MATERIAL LIST SEE P/L 950001
2. FOR SCHEMATICS SEE D900266 FOR MODEL 5000A, SEE D900294 FOR MODEL 504, SEE D900036 FOR MODEL 4041, SEE D900052 FOR MODEL 4042, SEE D900053 FOR MODEL 4043.
3. MARK WITH REVISION LETTER APPROX WHERE SHOWN.
5. CIRCUITRY SHOWN IS ON FAB FILE
6. ITEM 12 NOT SHOWN (USE ON MODEL 505 ONLY)
MC950092 4D-2
MC950091 4D- 1
MC950048 4J-1 1
MC950236 F-5 1
D950030 5000A 1
NEXT ASSY USED ON QTY
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES ± XX DEC ± XXX DEC ± SURFACE FINISH
DRAWN DATE
CHECK 9-14-76
ENG
MFG
KRUSE ELECTRONICS
BYSTRON DONNER
TITLE PC PLUG TIMING CAP ASSY
CODE IDENT. 29HH
SIZE C
DWG NO. 950031
REV A
SCALE 2/1
SHEET 1 OF

Figure 6.1 A1 Timing Capacitor Board Assembly

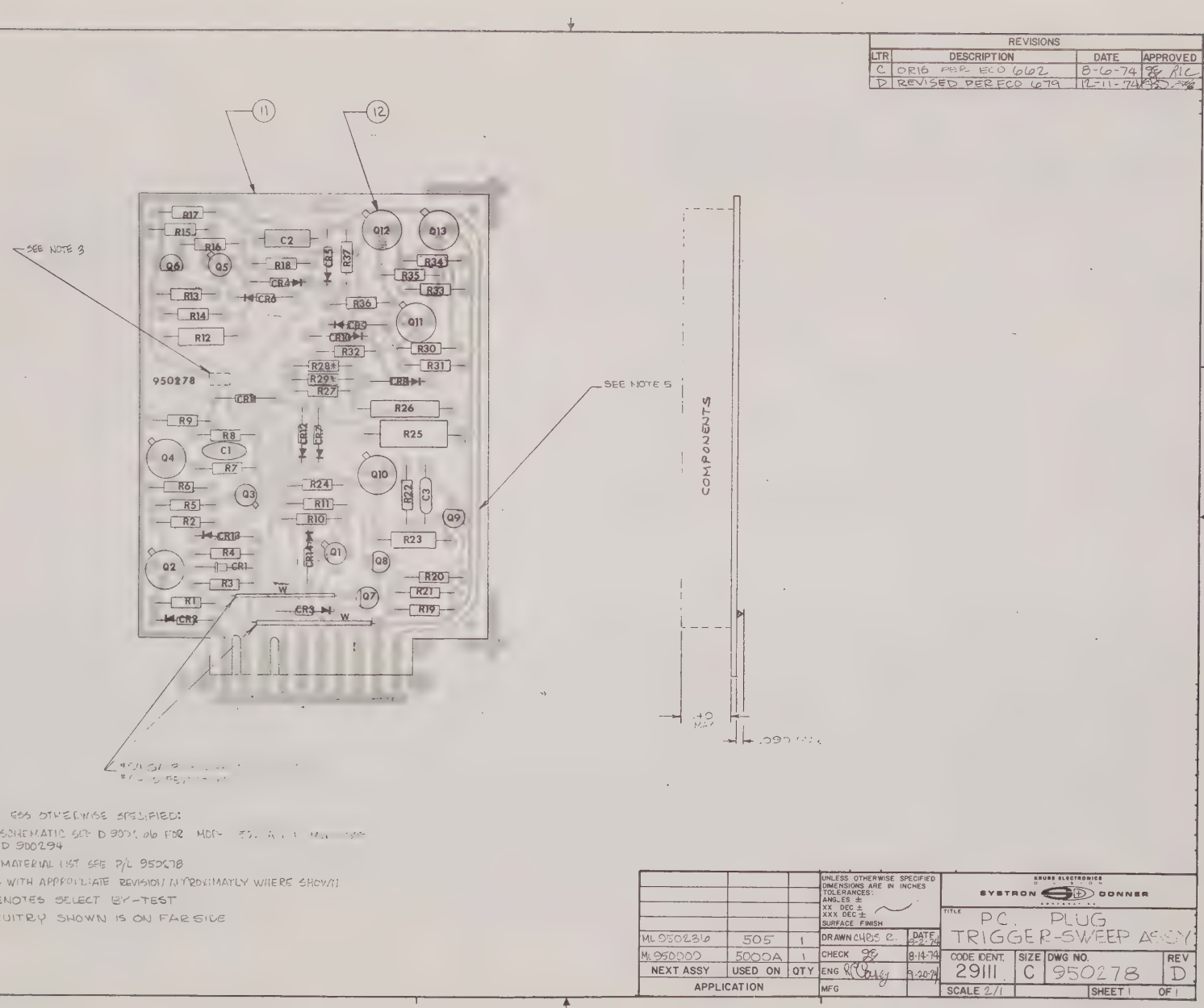


Figure 6.2 A2 Trigger Sweep Board Assembly

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A2R5	471462	C-4	Corning Resistor, Metal Film 18K, 1/4W, 2%
A2R7, R9	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A2R8, R11	475652	C-4	Corning Resistor, Fxd Composition 220K, 1/4W, 10%
A2R10	471484	C-4	Corning Resistor, Metal Film 150K, 1/4W, 2%
A2R12	470039	NA-60	Corning Resistor, Metal Film 162K, 1/4W, 1%
A2R13	471439	C-4	Corning Resistor, Metal Film 2K, 1/4W, 2%
A2R14	471463	C-4	Corning Resistor, Metal Film 20K, 1/4W, 2%
A2R15	471480	C-4	Corning Resistor, Metal Film 100K, 1/4W, 2%
A2R16, R31	471472	C-4	Corning Resistor, Metal Film 47K, 1/4W, 2%
A2R17	475659	CB3941	Allen Bradley Resistor, Fxd Composition 390K, 1/4W, 10%
A2R18	471448	C-4	Corning Resistor, Metal Film 4.7K, 1/4W, 2%
A2R19	475682	CB3351	Allen Bradley Resistor, Fxd Composition 3.3M, 1/4W, 10%
A2R20, R21	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A2R22	471424	C-4	Corning Resistor, Metal Film 470 ohm, 1/4W, 2%
A2R23	472220	C-5	Corning Resistor, Metal Film 1K, 1/2W, 2%
A2R24	471460	C-4	Corning Resistor, Metal Film 15K, 1/4W, 2%
A2R25	475825	GB3911	Allen Bradley Resistor, Fxd Composition 390 ohm, 1W, 10%
A2R26	470618	RN70C1001F	Sprague Resistor, Metal Film 1K, 1/2W, 1%

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A2R27	471440	C-4	Corning Resistor, Metal Film 2.2K, 1/4W, 2%
A2R28	- - -	- - -	Selected at test* (See Page 6-24)
A2R29	- - -	- - -	Selected at test* (See Page 6-24)
A2R30, R32 R35, R37	471470	C-4	Corning Resistor, Metal Film 39K, 1/4W, 2%
A2R33, R34	471438	C-4	Corning Resistor, Metal Film 1.8K, 1/4W, 2%
A2R36	475650	CB1841	Allen Bradley Resistor, Fxd Composition 180K, 1/4W, 10%
A2XQ2 thru XQ 13	480752	502-031-NY	Delbert Blinn Transistor Pad
A2TB1	936090	936090	S-D Blank P.C. Board
A3	950299	950299	S-D Operational Amplifier P.C. Board Assembly
A3C1	157005	192P1049R8	Sprague Capacitor, Mylar .1 MFD, 80V
A3C2	157002	192P1039R8	Sprague Capacitor, Mylar .01 MFD, 80V
A3C3	155508	DM15-221J	Elmenco Capacitor, Mica 220 PF, 500V
A3C4	155500	DM15-151J	Elmenco Capacitor, Mica 150 PF, 500V
A3C5	155530	DM15-681J	Elmenco Capacitor, Mica 680 PF, 500V
A3CR1, CR2	480004	IN4446	Sylvania Diode
A3CR3	480037	STB567	General Electric Diode
A3Q1	485014	2N4045	Solitron Transistor
A3Q2, Q3	485040	2N5087	Motorola Transistor
A3Q4	485004	2N2102	RCA Transistor
A3R1	470044	NA-60	Corning Resistor, Metal Film 475K, 1/4W, 1%

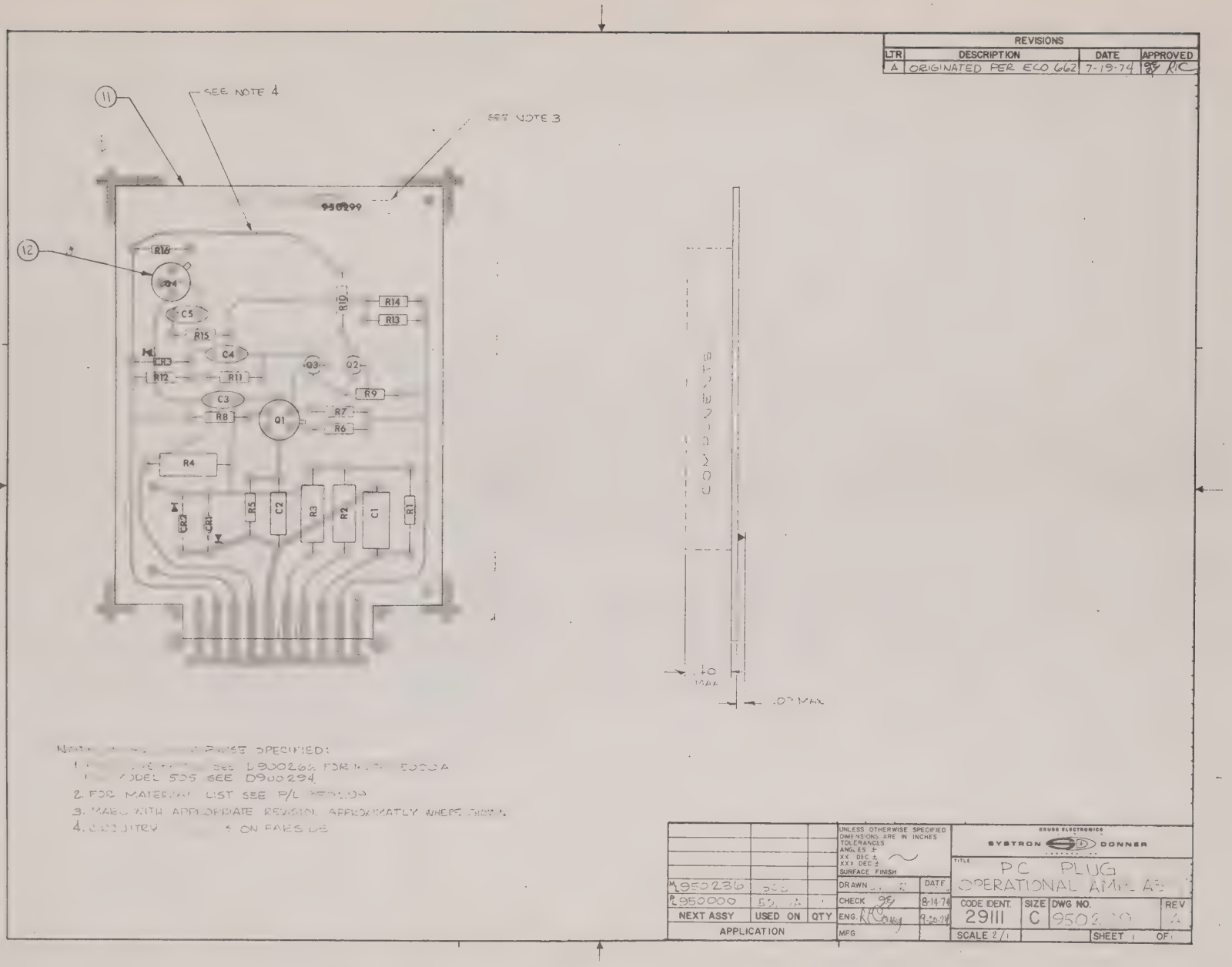


Figure 6.3 A3 Operational Amplifier Board Assembly

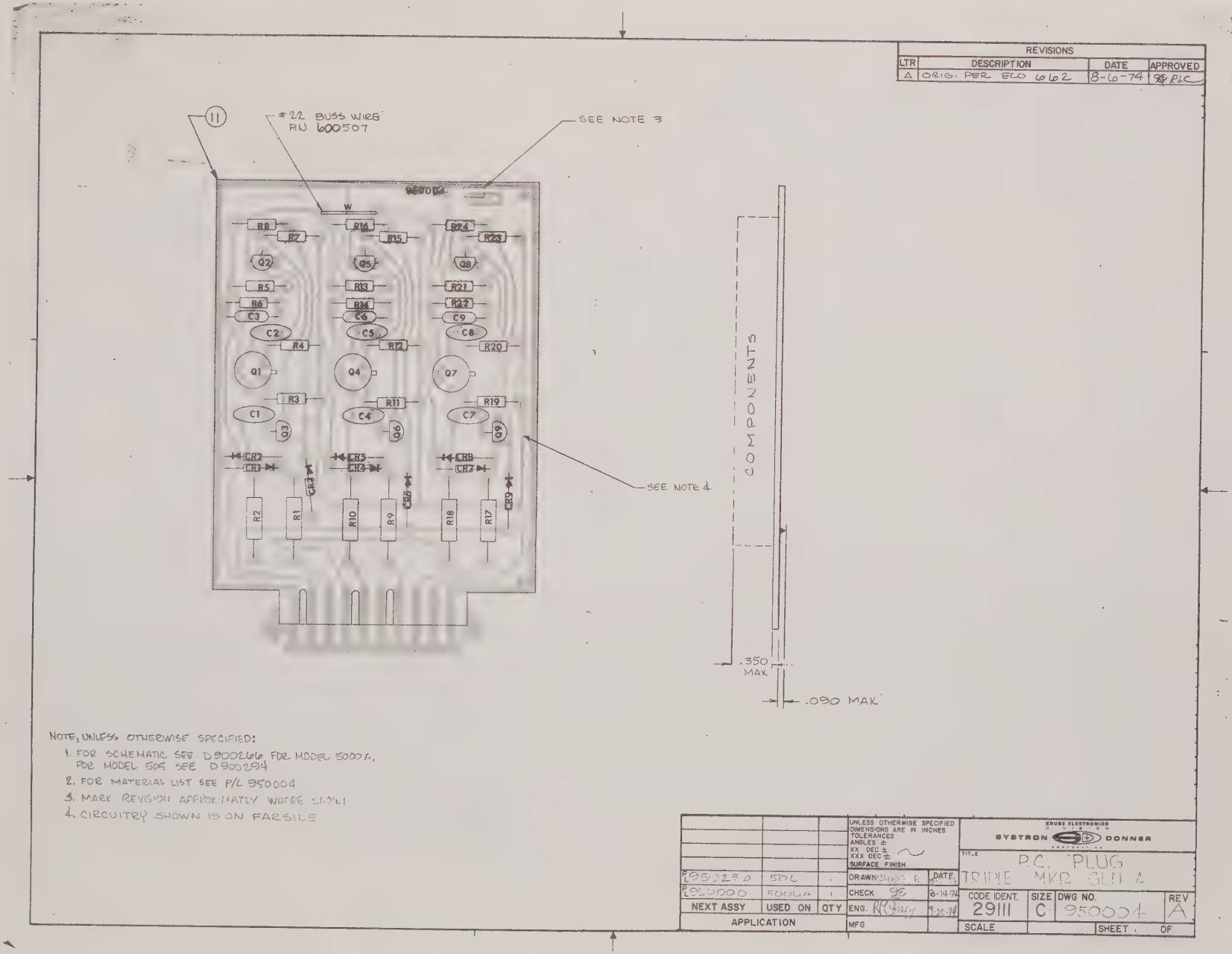

REVISIONS
LTR DESCRIPTION DATE APPROVED
A ORIG. PER ECO 6662 8-6-74
#22 BUSS WIRE RN 600507
SEE NOTE 3
SEE NOTE 4
COMPONENTS
.350 MAX
.090 MAX
NOTE, UNLESS OTHERWISE SPECIFIED:
1. FOR SCHEMATIC SEE D900266 FOR MODEL 5000A, FOR MODEL 505 SEE D900294
2. FOR MATERIAL LIST SEE P/L 950004
3. MARK REVISION APPROXIMATELY WHERE SHOWN
4. CIRCUITRY SHOWN IS ON FARSIDE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ANGLES ± XX DEC ± XXX DEC ± SURFACE FINISH
DRAWN DATE
CHECK 8-14-74
ENG. 9-20-74
MFG
APPLICATION
NEXT ASSY USED ON QTY
P950228 505 1
P950000 5000A 1
KRUSE ELECTRONICS SYSTRON DONNER
TITLE P.C. PLUG TRIPLE MKR GEN A
CODE IDENT. 29111
SIZE C
DWG NO. 950004
REV A
SCALE
SHEET OF

Figure 6.4 A4 Triple Marker Board Assembly

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A3R2, R3, R4	476565	RCL-7010	RCL Resistor, WW 25K, 1/4W, .1%
A3R5	471458	C-4	Corning Resistor, Metal Film 12K, 1/4W, 2%
A3R6, R7	471484	C-4	Corning Resistor, Metal Film 150K, 1/4W, 2%
A3R8	471480	C-4	Corning Resistor, Metal Film 100K, 1/4W, 2%
A3R9, R10 R11, R13, R14	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A3R12	471438	C-4	Corning Resistor, Metal Film 1.8K, 1/4W, 2%
A3R15	471404	C-4	Corning Resistor, Metal Film 68 ohm, 1/4W, 2%
A3R16	470705	C-3	Corning Resistor, Metal Film 27 ohm, 1/8W, 5%
A3XQ4	480752	502-031-NY	Delbert Blinn Transistor Pad
A3TB1	936022	936022	S-D Blank P.C. Board
A4	950004	950004	S-D Triple Marker Generator P.C. Board Assembly
A4C1, C2, C4 C5, C7, C8	155462	DM15-100D	Elmenco Capacitor, Mica 10 PF, 500V
A4C3, C6, C9	157000	192P2229R8	Sprague Capacitor, Filmite .0022 MFD, 80V
A4CR1 thru CR9	480004	IN4446	Sylvania Diode
A4Q1, Q4, Q7	485014	2N4045	Solitron Transistor
A4Q2, Q3, Q5, Q6, Q8, Q9	485040	2N5087	Motorola Transistor

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A4R1, R9, R17	476570	RCL-7010	RCL Resistor, WW 50K, 1/4W, .1%
A4R2, R10 R18	476565	RCL-7010	RCL Resistor, WW 25K, 1/4W, .1%
A4R3, R4, R11, R12, R19, R20	471464	C-4	Corning Resistor, Metal Film 22K, 1/4W, 2%
A4R5, R13, R21	471480	C-4	Corning Resistor, Metal Film 100K, 1/4W, 2%
A4R6, R14, R22	471461	C-4	Corning Resistor, Metal Film 16K, 1/4W, 2%
A4R7, R15	471432	C-4	Corning Resistor, Metal Film 1K, 1/4W, 2%
A4R8, R16, R24	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A4R23	471434	C-4	Corning Resistor, Metal Film 1.2K, 1/4W, 2%
A4TB1	936009	936009	S-D Blank P.C. Board
A5	950215	950215	S-D Dual Precision Regulator P.C. Board Assembly
A5C1	155470	DM15-270J	Elmenco Capacitor, Mica 27 PF, 500V
A5C2, C6, C7, C3	157005	192P1049R8	Sprague Capacitor, Mylar .1 MFD, 80V
A5C4, C8	152410	TE-1307	Sprague Capacitor, Elect 50 MFD, 50V
A5CR1	480011	IN827	Centralab Diode
A5CR4, CR5	480041	IN5232	Motorola Diode, 5.6V
A5HDQ1, Q2	480750	TXBF-032-025B	IERC Heat Dissipator

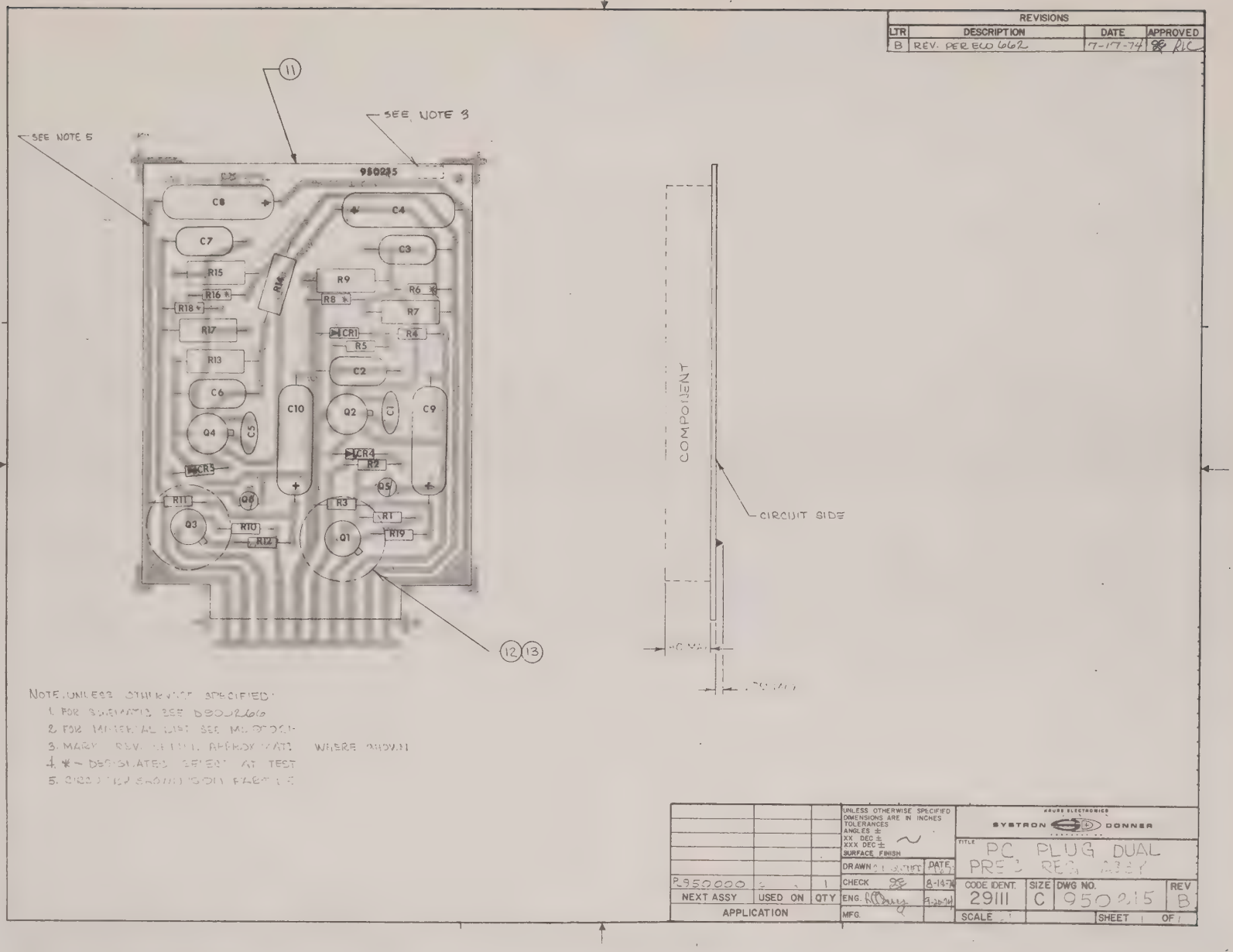


Figure 6.5 A5 Dual Precision Regulator Board Assembly

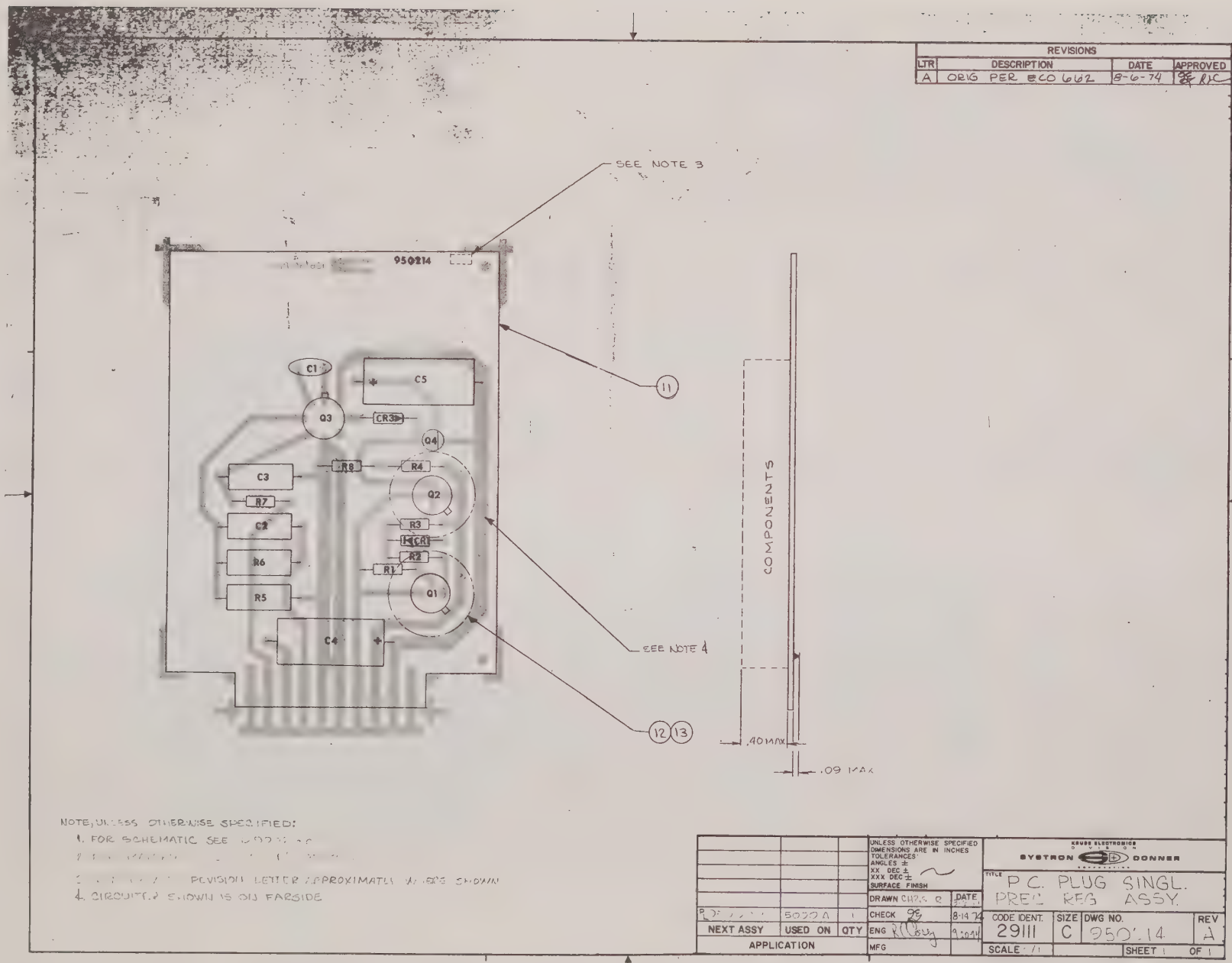


Figure 6.6 A6 Single Precision Regulator Board Assembly

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A5Q1, Q3	485004	2N2102	RCA Transistor
A5Q2, Q4	485655	LM301A	National Semiconductor IC
A5Q5, Q6	485006	2N3391	GE
A5R1, R10	471432	C-4	Corning Resistor, Metal Film 1K, 1/4W, 2%
A5R2	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A5R3	471463	C-4	Corning Resistor, MF 20K, 1/4W, 2%
A5R4	471438	C-4	Corning Resistor, Metal Film 1.8K, 1/4W, 2%
A5R5	471433	C-4	Corning Resistor, Metal Film 1.1K, 1/4W, 2%
A5R6	- - -	- - -	Selected at test* (See Page 6-24)
A5R7	476981	RCL-7010	RCL Resistor, WW 3.9K, 1/4W, 1%
A5R8	- - -	- - -	Selected at test* (See Page 6-24)
A5R9	476971	RCL-7010	RCL Resistor, WW 1.73K, 1/4W, 1%
A5R11	471464	C-4	Corning Resistor, MF, 22K, 1/4W, 2%
A5R12	471426	C-4	Corning Resistor, MF, 560Ω, 1/4W, 2%
A5R13	476650	RCL-7010	RCL Resistor, WW 2.5K, 1/4W, .1%
A5R14, R15	476983	RCL-7010	RCL Resistor, WW 5K, 1/4W, 1%
A5R16	- - -	- - -	Selected at test* (See Page 6-24)
A5R17	476984	RCL-7010	RCL Resistor, WW 10K, 1/4W, 1%
A5R18	- - -	- - -	Selected at test* (See Page 6-24)
A5XQ1, XQ3	480752	502-031-NY	Delbert Blinn Transistor Pad
A5TB1	936161	936161	S-D Blank P.C. Board
A6	950214	950214	S-D Single Precision Regulator P.C. Board Assembly

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A6C1	155462	DM15-100D	Elmenco Capacitor, Mica 10 PF, 500V
A6C2, C3	157005	192P1049R8	Sprague Capacitor, Mylar .1 MFD, 80V
A6C4, C5	152410	TE-1307	Sprague Capacitor, Elect 50 MFD, 50V
A6CR1	480037	STB567	General Electric Diode
A6CR3	480062	IN5240	Motorola Diode
A6HDQ1, Q2	480750	TXBF-032-025B	IERC Heat Dissipator
A6Q1, Q2	485004	2N2102	RCA Transistor
A6Q3	480655	LM301A	National Semiconductor IC
A6Q4	485006	2N3391	General Electric Transistor
A6R1	471458	C-4	Corning Resistor, Metal Film 12K, 1/4W, 2%
A6R2	471412	C-4	Corning Resistor, Metal Film 150 ohm, 1/4W, 2%
A6R3	471442	C-4	Corning Resistor, Metal Film, 2.7K, 1/4W, 2%
A6R4	471426	C-4	Corning Resistor, MF, 560 Ω, 1/4W, 2%
A6R5	476984	RCL-7010	RCL Resistor, WW 10K, 1/4W, 1%
A6R6	476983	RCL-7010	RCL Resistor, WW 5K, 1/4W, 1%
A6R7	471444	C-4	Corning Resistor, Metal Film 3.3K, 1/4W, 2%
A6R8	471468	C-4	Corning Resistor, MF 33K, 1/4W, 2%
A6XQ1, XQ2	480752	502-031-NY	Delbert Blinn Transistor Pad
A6TB1	936160	936160	S-D Blank P.C. Board
A7	950218	950218	S-D Power Supply P.C. Board Assembly
A7C1	152760	91C300HB241	STM Capacitor, Elect 240 MFD, 300V
A7C2, C3	152436	91C60HB33	STM Capacitor, Elect 3500 MFD, 50 V
A7CR1	480042	1N4006	Dickson Diode
A7CR2-CR9	480003	IN4005	Dickson Diode

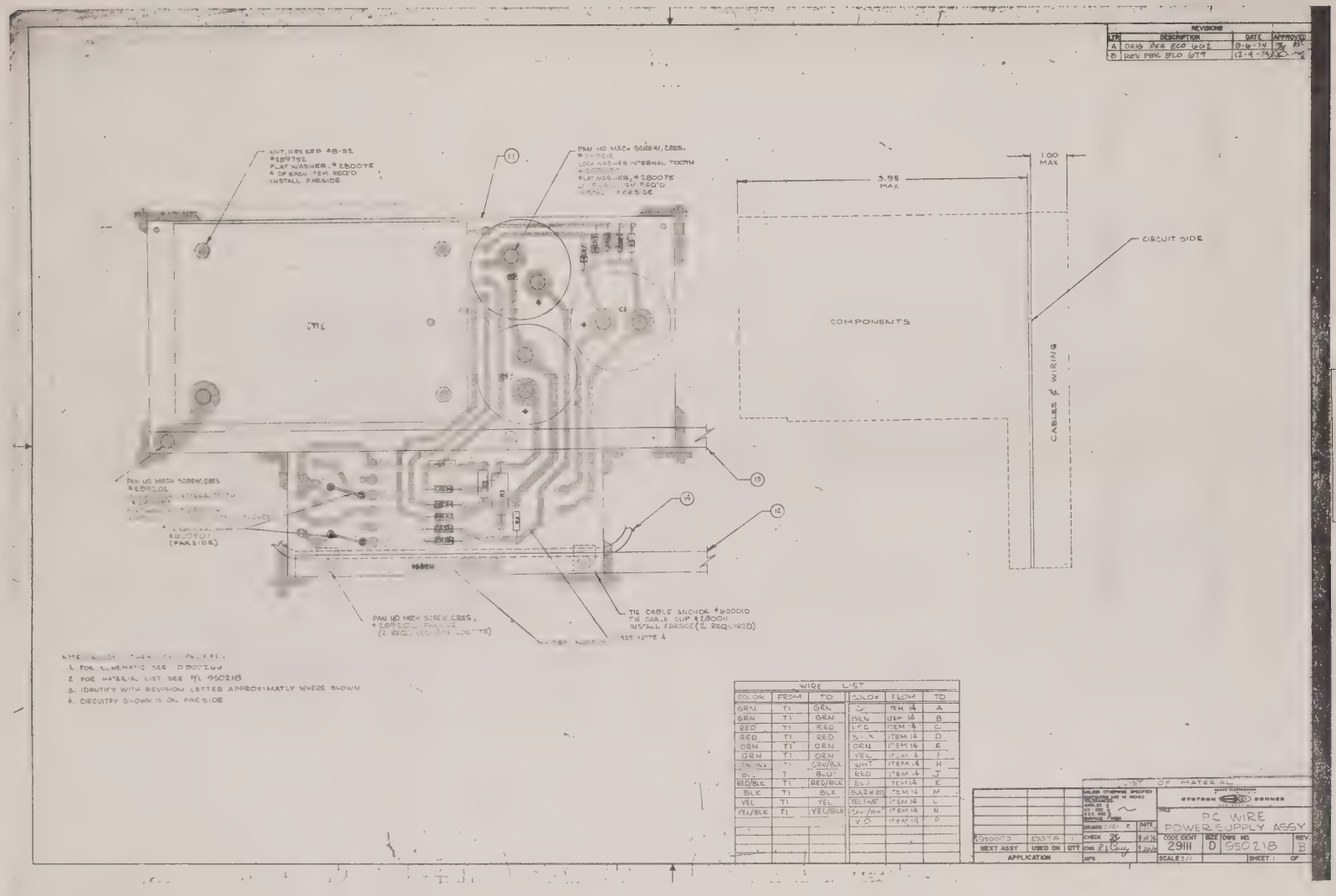

REVISIONS
LTR DESCRIPTION DATE APPROVED
A ORIG REL ECO 6002 8-6-74
B REV PER ECO 6719 12-9-74
NUT, HEX KEP 4-32 #289752 FLAT WASHER, #280075 4 OF EACH ITEM REQ'D INSTALL FARSIDE
PAN HD MACH SCREW, CRES. #280012 LOCKWASHER INTERNAL TOOTH #280031 FLAT WASHER #280075 2 OF EACH ITEM REQ'D INSTALL FARSIDE
3.95 MAX
1.00 MAX
CIRCUIT SIDE
COMPONENTS
CABLES & WIRING
PAN HD MACH SCREW, CRES. #280202
(FARSIDE)
PAN HD MACH SCREW, CRES. #280202 (2 REQUIRED) INSTALL FARSIDE
TIE CABLE ANCHOR #600010
TIE CABLE CLIP #280011 INSTALL FARSIDE (2 REQUIRED)
SEE NOTE 4
NOTES: UNLESS OTHERWISE SPECIFIED
1. FOR SCHEMATIC SEE D950218
2. FOR MATERIAL LIST SEE P/L 950218
3. IDENTIFY WITH REVISION LETTER APPROXIMATELY WHERE SHOWN
4. CIRCUITRY SHOWN IS ON FARSIDE
WIRE LIST
CO. OK FROM TO
GRN T1 GRN
GRN T1 GRN
RED T1 RED
RED T1 RED
ORN T1 ORN
ORN T1 ORN
GRN/BLK T1 GRN/BLK
BLU T BLU
RED/BLK T1 RED/BLK
BLK T1 BLK
YEL T1 YEL
YEL/BLK T1 YEL/BLK
COLOR FROM TO
GRN ITEM 14 A
BRN ITEM 14 B
RED ITEM 14 C
BLK ITEM 14 D
ORN ITEM 14 E
YEL ITEM 14 F
WHT ITEM 14 H
RED ITEM 14 J
BLU ITEM 14 K
BARRIER ITEM 14 M
YEL/WHT ITEM 14 L
BLU/WHT ITEM 14 N
VIO ITEM 14 P
LIST OF MATERIAL
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON TWO PLACE DECIMALS ± .01
ANG. ± 1°
THREE PLACE DECIMALS ± .005
SURFACE FINISH
DRAWN CMC 8 DATE
CHECK 8-14-74
ENG RL Gray 9-10-74
MFR
SCALE 2/1
CYGNET CONNER
TITLE PC WIRE POWER SUPPLY ASSY
D950218
CODE IDENT 29111
SIZE D
DWG NO 950218
REV B
SHEET 1 OF
D950218
B
NEXT ASSY USED ON QTY
APPLICATION

Figure 6.7 A7 Power Supply Board Assembly

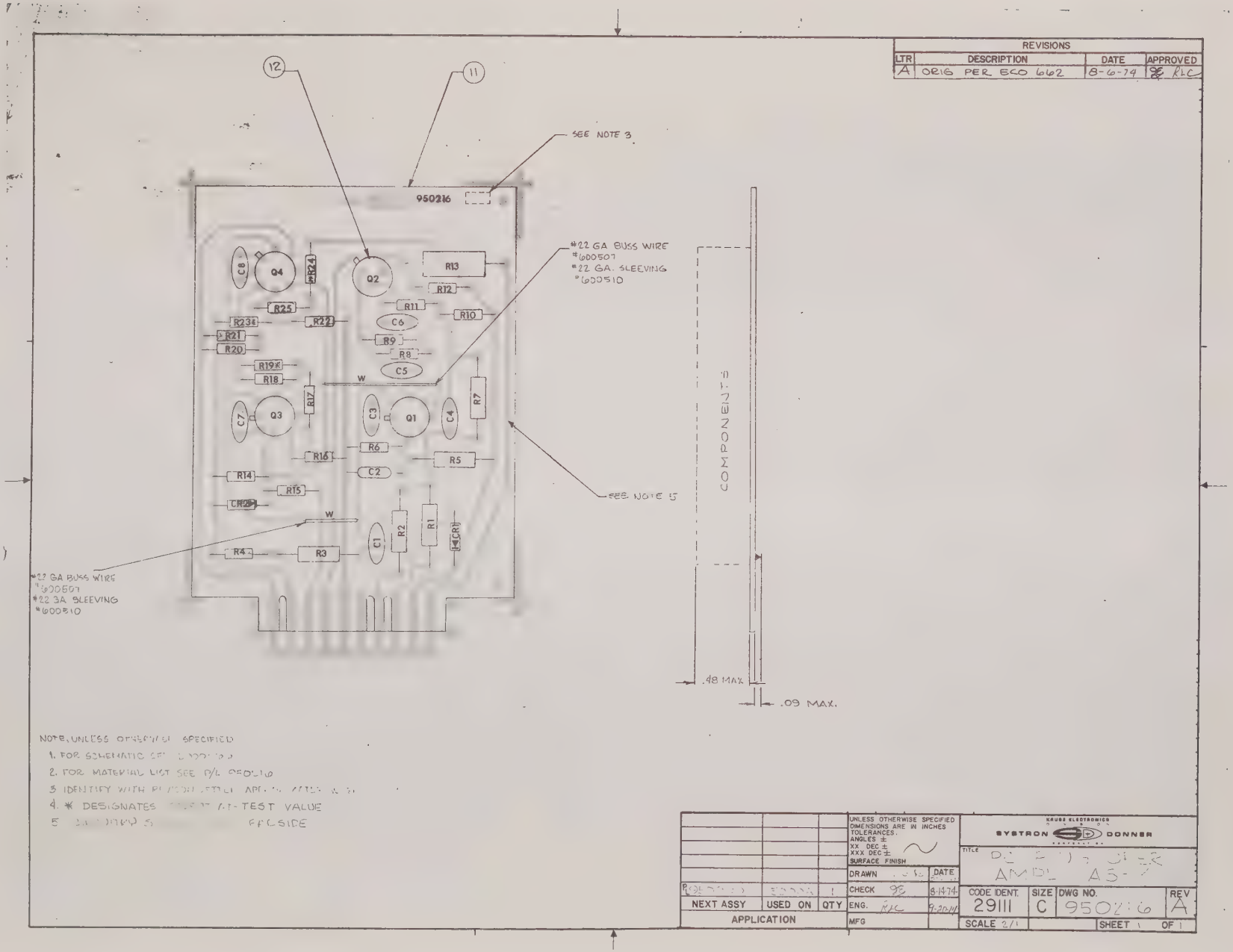


Figure 6.8 A8 Operational Amplifier Board Assembly

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A7R1	475760	EB6831	Allen Bradley Resistor, Fxd Composition 68K, 1/2W, 10%
A7R2	472223	C-5	Corning Resistor, MF 2.2K, 1/2W, 2%
A7R3	475880	GB1041	Allen Bradley Resistor, Fxd Composition 100K, 1W, 10%
A7R4, R5	471468	C-4	Corning Resistor, Metal Film 33K, 1/4W, 2%
A7T1	560009	4-2545	Tranex Transformer, Spec Control B962044
A7TB1	936156	936156	S-D Blank P.C. Board
A8	950216	950216	S-D Operational Amplifier P.C. Board Assembly
A8C1, C4	155467	DM15-220J	Elmenco Capacitor, Mica 22 PF, 500V
A8C2	157002	192P1039R8	Sprague Capacitor, Mylar .01 MFD, 80V
A8C3, C7, C8	155470	DM15-270J	Elmenco Capacitor, Mica 27 PF, 500V
A8C5	155500	DM15-151J	Elmenco Capacitor, Mica 150 PF, 500V
A8C6	155530	DM15-681J	Elmenco Capacitor, Mica 680 PF, 500V
A8CR1, CR2	480041	1N5232	Motorola Diode, 5.6 V
A8Q1, Q3, Q4	480655	LM301A	National Semiconductor IC, Op. Amp.
A8Q2	485004	2N2102	RCA Transistor
A8R15, R17, R18, R20	471465	C-4	Corning Resistor, MF, 24K, 1/4W, 2%
A8R2, R7, R1	476565	RCL-7010	RCL Resistor, WW 25K, 1/4W, /.1%
A8R3	476987	RCL-7010	RCL Resistor, WW 8.2K, 1/4W, 1%
A8R4, R22	471408	C-4	Corning Resistor, Metal Film 100 ohm, 1/4W, 2%*
A8R5	476595	CB 1044	Allen Bradley Resistor, WW 100K, 1/4W, 1/2%

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A8R6, R8, R25	471458	C-4	Corning Resistor, Metal Film 12K, 1/4W, 2%
A8R9	471432	C-4	Corning Resistor, Metal Film 1K, 1/4W, 2%
A8R10, R12	471456	C-4	Corning Resistor, Metal Film 10K, 1/4W, 2%
A8R11	471404	C-4	Corning Resistor, Metal Film 68 ohm, 1/4W, 2%
A8R13	475410	C-4	Corning Resistor, Fxd Composition 2K, 2W, 5%
A8R14	471480	C-4	Corning Resistor, Metal Film 100K, 1/4W, 2%
A8R16	471463	C-4	Corning Resistor, Metal Film 20K, 1/4W, 2%
A8R19	- - -	- - -	Select at test* (See Page 6-24)
A8R21	- - -	- - -	Selected at test* (See Page 6-24)
A8R23	- - -	- - -	Selected at test* (See Page 6-24)
A8R24	- - -	- - -	Selected at test* (See Page 6-24)
A8XQ2	480752	502-031-NY	Delbert Blinn Transistor Pad
A8TB1	936157	936157	S-D Blank P.C. Board
A9	950168	950168	S-D Sweep-Second P.C. Board Assembly
A9C1	157002	192P1039R8	Sprague Capacitor, Mylar .01 MFD, 80V
A9CR1, CR3	480065	IN5245	Motorola Diode
A9CR2, CR4, CR5	480004	IN4446	Sylvania Diode
A9R1	470042	NA-60	Corning Resistor, Metal Film 1.87M, 1/4W, 1%
A9R2	470041	NA-65	Corning Resistor, Metal Film 1.62M, 1/4W, 1%

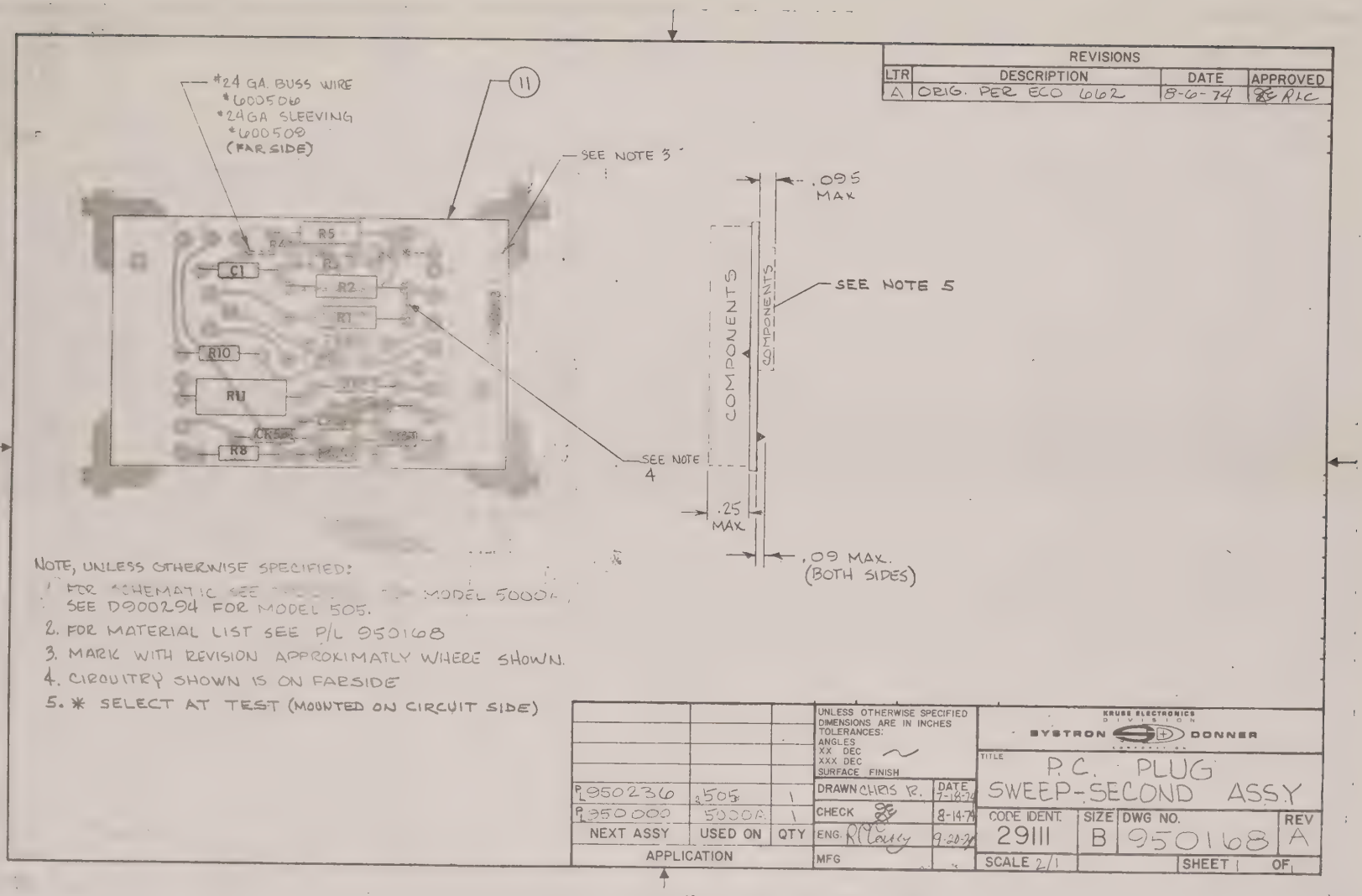

REVISIONS
LTR DESCRIPTION DATE APPROVED
A ORIG. PER ECO 662 8-6-74
*24 GA. BUSS WIRE *600508
*24GA SLEEVING *600509
(FAR SIDE)
11
SEE NOTE 3
.095 MAX
SEE NOTE 5
COMPONENTS
SEE NOTE 4
.25 MAX
.09 MAX. (BOTH SIDES)
NOTE, UNLESS OTHERWISE SPECIFIED:
1. FOR SCHEMATIC SEE MODEL 5000A, SEE D900294 FOR MODEL 505.
2. FOR MATERIAL LIST SEE P/L 950168
3. MARK WITH REVISION APPROXIMATLY WHERE SHOWN.
4. CIRCUITRY SHOWN IS ON FARSIDE
5. * SELECT AT TEST (MOUNTED ON CIRCUIT SIDE)
P/L 950236 505 1
P/L 950000 5000A 1
NEXT ASSY USED ON QTY
APPLICATION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES: ANGLES XX DEC XXX DEC SURFACE FINISH
DRAWN CHRIS R. DATE 7-18-74
CHECK 8-14-74
ENG. R Clancy 9-20-74
MFG
KRUSE ELECTRONICS DIVISION BYSTRON DONNER
TITLE P.C. PLUG SWEEP-SECOND ASSY
CODE IDENT. 29111
SIZE B
DWG NO. 950168
REV A
SCALE 2/1
SHEET 1 OF 1

Figure 6.9 A9 Sweep-Second Board Assembly

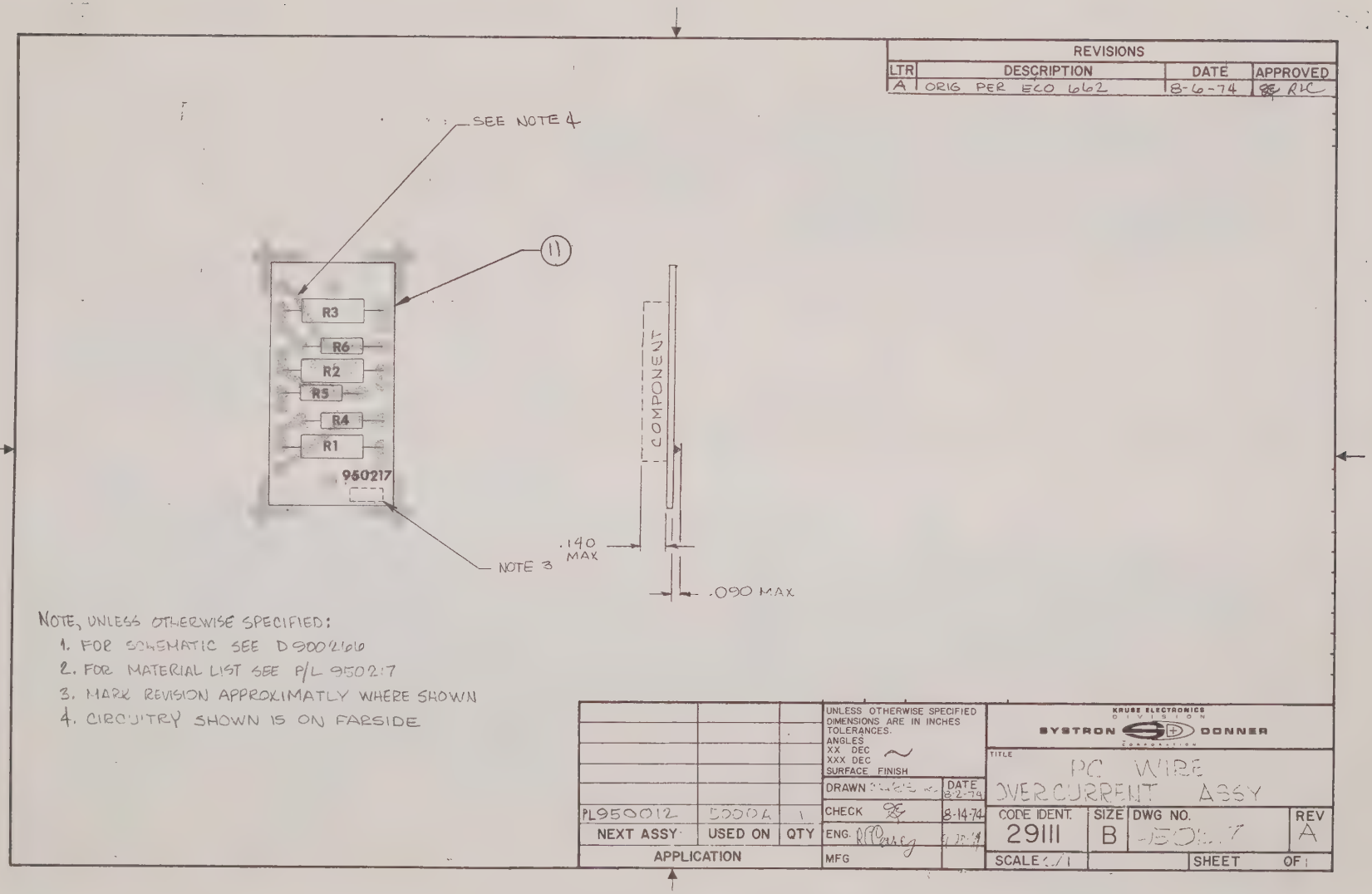


Figure 6.10 A10 Overcurrent Board Assembly

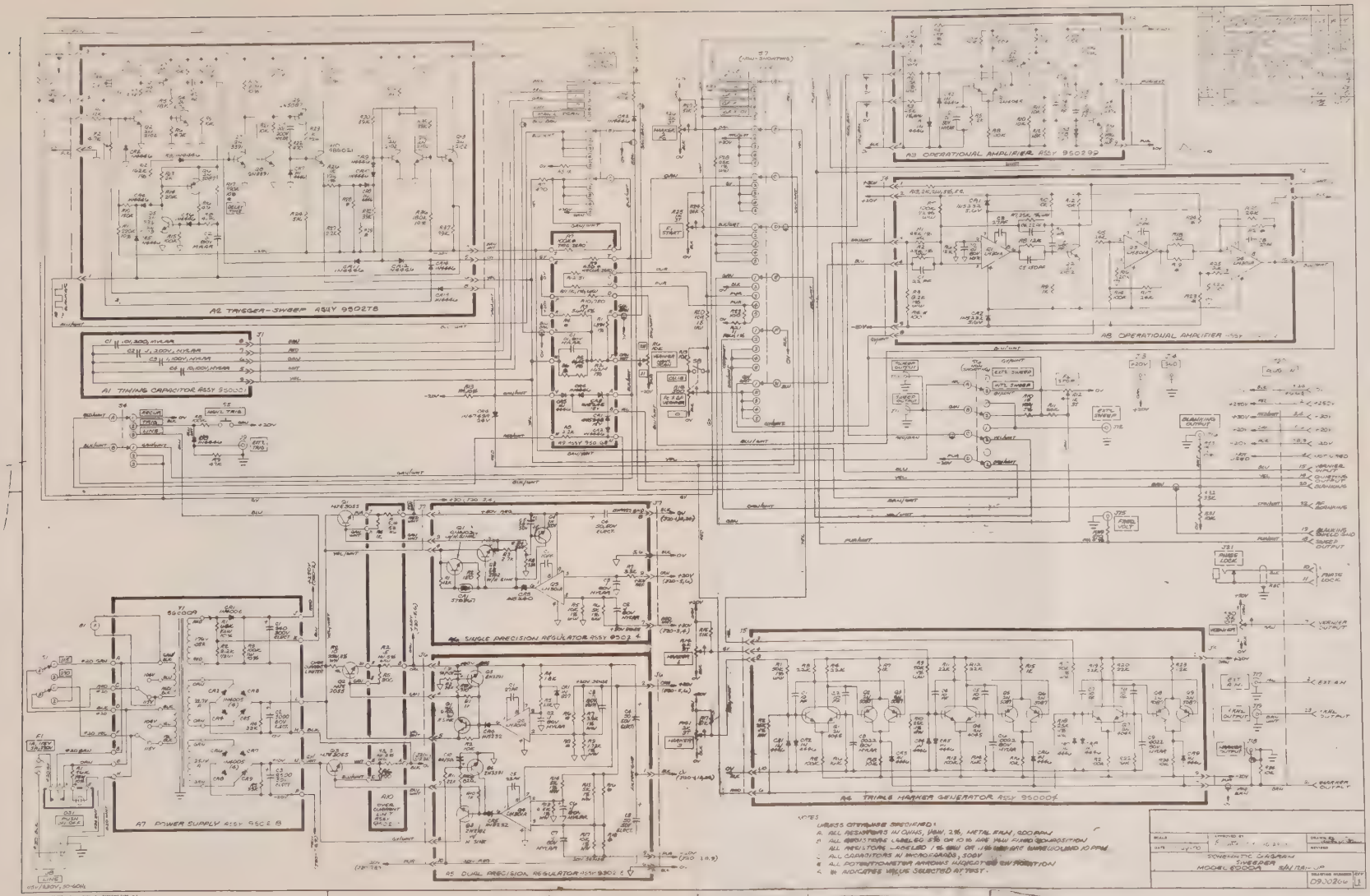
CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
A9R3	475149	CB5655	Allen Bradley Resistor, Fxd Composition 5.6M, 1/4W, 5%
A9R4	- - -	- - -	Selected at test* (See Page 6-24)
A9R5	470045	NA-60	Corning Resistor, Metal Film 464K, 1/4W, 1%
A9R6	- - -	- - -	Selected at test* (See Page 6-24)
A9R7	471480	C-4	Corning Resistor, Metal Film 100K 1/4W, 2%
A9R8	471440	C-4	Corning Resistor, Metal Film2.2K, 1/4W, 2%
A9R9	471423	C-4	Corning Resistor, Metal Film 430 ohm, 1/4W, 2%
A9R10	471429	C-4	Corning Resistor, Metal Film 750 ohm, 1/4W, 2%
A9R11	476977	RCL-7010	RCL Resistor, WW 1K, 1/4W, 1%
A9R12	471401	C-4	Corning Resistor, Metal Film 51 ohm, 1/4W, 2%
A9TB1	936072	936072	S-D Blank P.C. Board
A10	950217	950217	S-D Over Current Limit P.C. Board Assembly
A10R1, R2, R3	477000	RS1A	Dale Resistor, WW, 0.5 ohm, 1W, 5%
A10R4	471432	C-4	Corning Resistor, Metal Film 1K, 1/4W, 2%
A10R5	471419	C-4	Corning Resistor, Metal Film 300 ohm, 1/4W, 2%
A10R6	471408	C-4	Corning Resistor, Metal Film 100 ohm 1/4W, 2%
A10TB1	936163	936163	S-D Blank P.C. Board
A11	950007	950007	S-D Extender P.C. Board Assembly
A11J1	210008	50A-10A-20	Cinch P.C. Edge Connector
A11TB1	936027	936027	S-D Blank P.C. Board

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
			CHASSIS PARTS
CR1 thru CR3	480004	IN4446	Sylvania Diode
CR4	480006	IN4749A	Motorola Diode, 24V
DS1	510028	616-6-1-AIH	Marco Oak Switch, Power W/Lamp
	390004	BA1-B	Neon Lamp
F1	510001	313001	Littlefuse Fuse, Slo Blo
G1	600000	172585	Belden AC Power Cord
J1 thru J7	210008	50-10A-20	Cinch P.C. Edge Connector
J8	210050	AC3G	Switchcraft AC Receptacle
J9 (for A11)	210008	50-10A-20	Cinch P.C. Edge Connector
J10 thru J12 J15 thru J19	210011	31-221-1056	Amphenol Connector, BNC
J13	210026	221	Smith Red Tip Jack
J14	210025	101	Smith Plain Tip Jack
J20	210010	29-190-24	Amphenol Connector, 24 Pins
J21	510029	142A	Switchcraft Phone Jack
P21	510030	780	Switchcraft Phone Plug
Q1 thru Q3	485011	MJE 3055	Motorola Transistor
R1	475550	BB5631	Allen Bradley Resistor, Fxd Composition 56K, 1/8W, 10%
R2	477286	RH25	Dale Resistor, WW 10 ohm, 25W, 3%
R3	475695	CB1261	Allen Bradley Resistor, Fxd Composition 12M, 1/4W, 10%
R4	471484	C-4	Corning Resistor, Metal Film 150K, 1/4W, 2%

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
R5	471432	C-4	Corning Resistor, Metal Film 1K, 1/4W, 2%
R6 (S3)	510024	C2-212-AW-58013	CTS (Referece S3)Potentiometer, 10K
R7	471424	C-4	Corning Resistor, Metal Film 470 ohm 1/4W, 2%
R8	471480	C-4	Corning Resistor, MF, 100K, 1/4W, 2%
R9	471472	C-4	Corning Resistor, Metal Film 47K 1/4W, 2%
R10	470702	C-3	Corning Resistor, Metal Film 15 ohm 1/8W, 5%
R11, R24 *	471465	C-4	Corning Resistor, Metal Film 24K, 1/4W, 2%
R12, R25 *	479665	962041-1	Duncan Potentiometer, 1K, 3 Turns
R13	475678	CB1051	Allen Bradley Resistor, Fxd Composition 1M, 1/4W, 10%
R14, R16, R26 *	479662	962041-2	Duncan Potentiometer 2K, 3Turns
R15, R17 R27 *	471473	C-4	Corning Resistor, Metal Film 51K,
R18 (S7)	510025	X5P2115	CTS Keene (Part of S7 Assy)
R31, R34	471456	C-4	Corning Resistor, Metal Film 10K,
R20	476563	RCL-7010	RCL Resistor, WW 10K, 1/4W, .1%
R21	470501	NA-55	Corning Resistor, Metal Film 11 ohm, 1/8W, 1%
R22	- - -	- - -	Not Assigned
R23	471408	C-4	Corning Resistor, Metal Film 100 ohm, 1/4W, 2%
R28	476565	RCL-7010	RCL Resistor, WW 25K, 1/4W, .1%
R29	474925	GB5145	Allen Bradley Resistor, Fxd Composition 510 ohm, 1W, 5%

* Part of Dial System Assembly ML 950014

CIRCUIT REFERENCE	S-D PART NO.	MFG. PART NO.	MANUFACTURER AND DESCRIPTION
R30	479676	7246-R10KL25	Beckman Helipot Potentiometer, Var. 10K, 10T
R32	471468	C-4	Corning Resistor, Metal Film 33K, 1/4W, 2%
R33	475800	GB1021	Allen Bradley Resistor, Fxd Composition 1K, 1W, 10%
S1	510040	462564LF	Switchcraft Slide Switch
S2			Not Assigned
S3 (R6)	510024	C2-212-AW-58013	CTS Keene 2 Deck Switch W/Potentiometer Assembly CTS 2 Deck Switch W/Potentiometer
S4	960043	960043	S-D Lever Switch
S5	510022	30-1	Grayhill Switch, Push Button
S6	510041	50212L	Switchcraft Slide Switch
S7 (R18)	510025	C4-215-GC-321	CTS Keene 4 Deck Switch W/Potentiometer Assembly CTS 4 Deck Switch W/Potentiometer CTS Spec. # X5P2115
XF1	510010	342004	Littlefuse Fuse Holder
B1	260001	8500	Pamotor Fan
			*All "Select in test" components are Corning C-4 series, 1/4W, 2% resistors. Resistance values ranging from 10 ohms to 22 Megohms (decade values) are stocked in test and selected. Where a value is specified for a "Select in test" component, that is the nominal value, and is changed in test only when necessary for special compensation or other effect.


A2 TRIGGER-SWEEP ASSY 950278
A1 TIMING CAPACITOR ASSY 950031
A3 OPERATIONAL AMPLIFIER ASSY 950299
A8 OPERATIONAL AMPLIFIER ASSY
A4 SINGLE PRECISION REGULATOR ASSY 9503
A5 DUAL PRECISION REGULATOR ASSY 9502
A7 POWER SUPPLY ASSY 950218
A6 TRIPLE MARKER GENERATOR ASSY 950004
SCHEMATIC DIAGRAM
MODEL 5000A
09302

D900266

Figure 6.11 Schematic Diagram

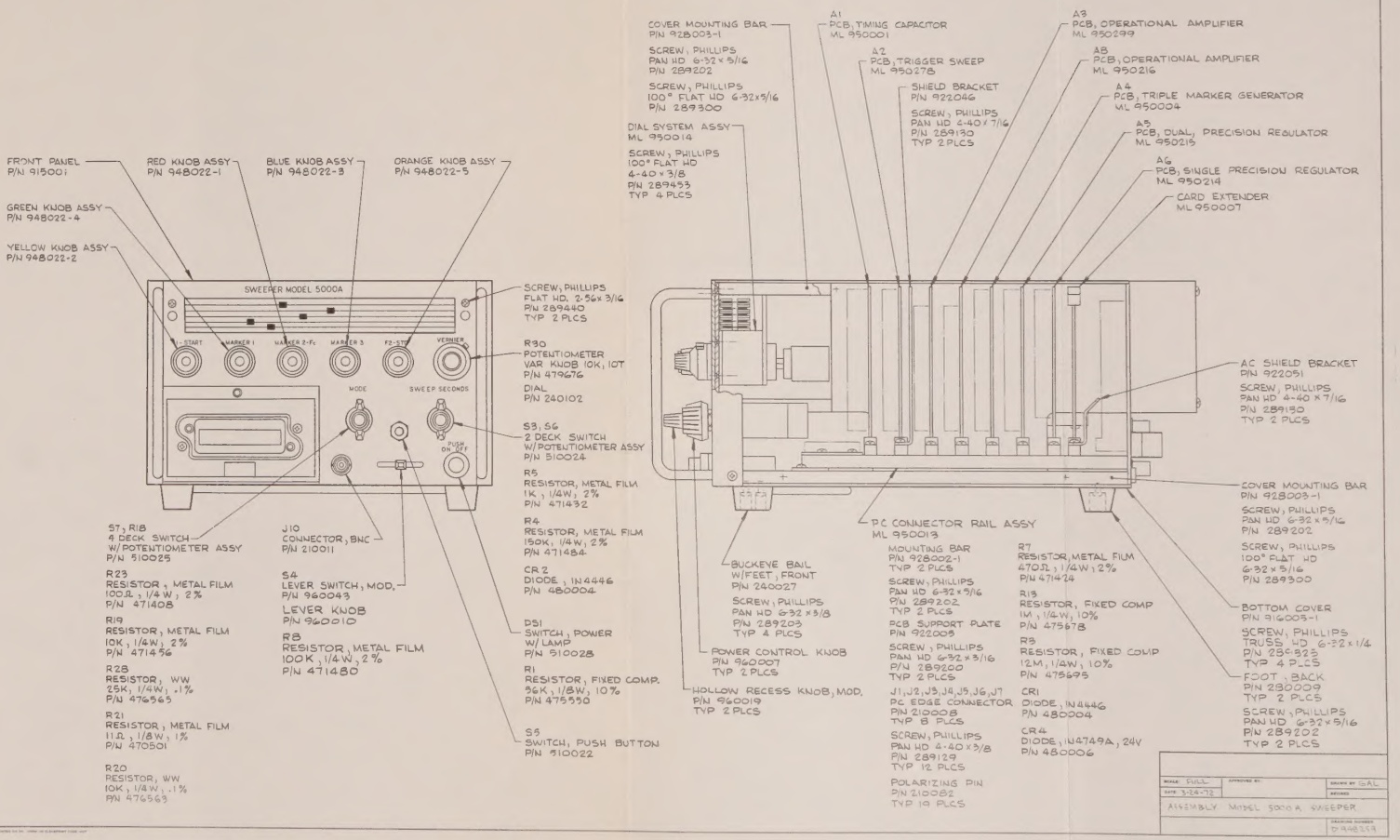


Figure 6.12 Assembly Drawing
(Sheet 1 of 2)

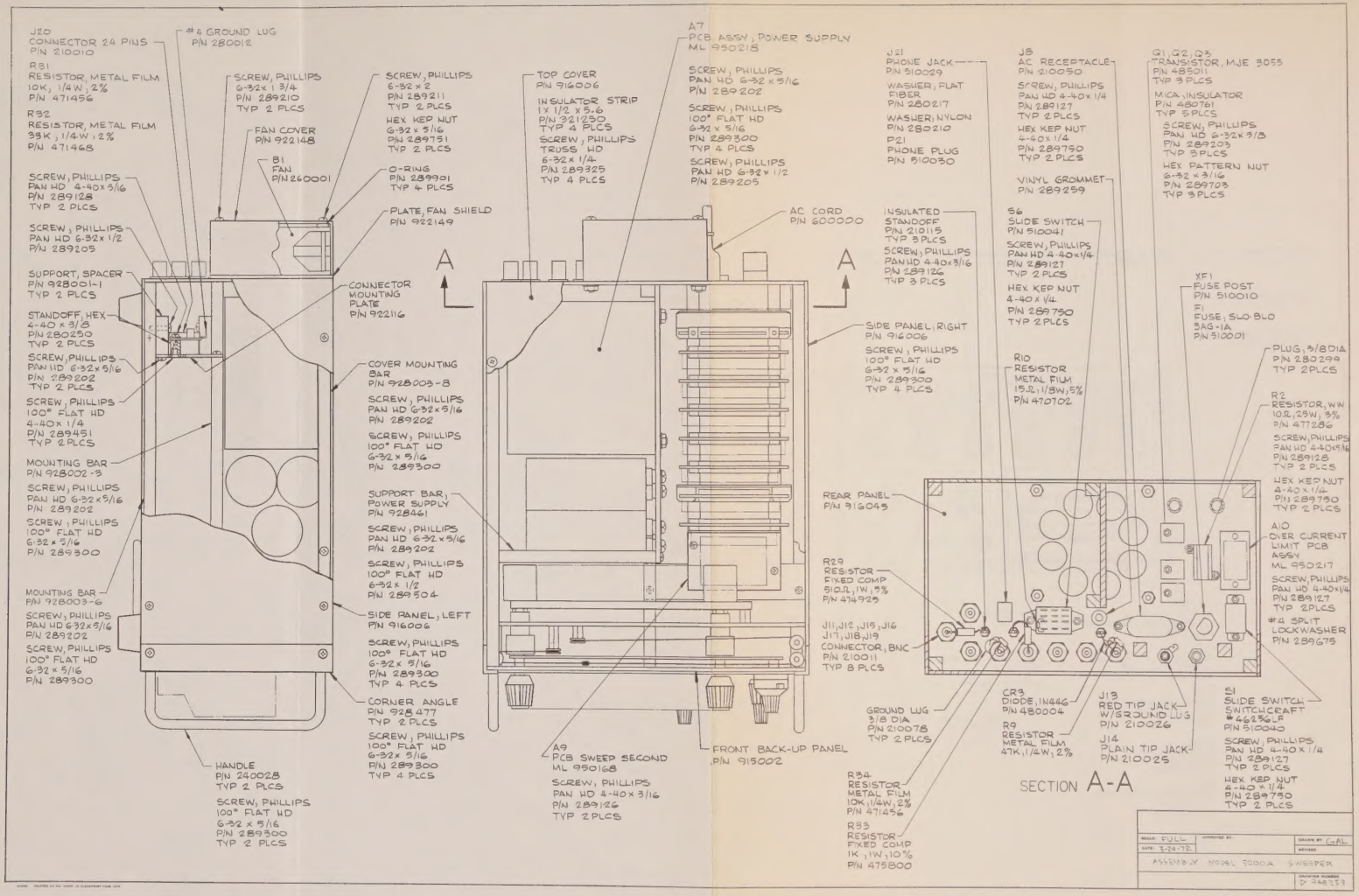


Figure 6.12 Assembly Drawing
(Sheet 2 of 2)

www.manualsplus.com
1024967